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West Europe Report

SCIENCE AND TECHNOLOGY

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ADVANCED MATERIALS

SNIAS, CIBA-GEIGY WORK ON COMPOSITES FOR INDUSTRIAL USE

Duesseldorf VDI NACHRICHTEN in German 24 Aug 84 p 22

/Excerpts/ There are two reasons why industry was able to develop a new generation of high-power construction materials. On the one hand, progress in the areas of aerospace, defense technology, atomic power and electronics, which is due to their high technological standards and, on the other hand, the challenges which the unstable energy supply market naturally poses. Due to technological developments, these new materials, which are high-performance composites, can increasingly be used in the most various industrial branches.

When the oil crisis showed its effects for the first time, the oil industry reacted with deeper borings to reach previously untapped off-shore deposits. This necessarily entailed equipment which provided better technical performance and which was more reliable. It turned out that composites were the best problem solution for this. In a trailblazing application, the French Société Nationale Industrielle Aérospatiale (SNIAS) used stronger composite materials in the aerospace industry. Today, in collaboration with the Institute Francais du Pétrole, it is involved in the development of drilling pipes made of epoxy resin with a reinforcement of glass and/or carbon fibers. Pipes made of this composite are stable against pressure at drilling depths up to 300 m, but they have only 25 percent to 30 percent of the weight of comparable metal pipes.

In Great Britain, GKN Technology has likewise developed leafsprings of composites with glass. Similar springs made from epoxy resin with 70 percent glass fiber reinforcement come from the developments at the Institute for Plastic Processing (Federal Republic of Germany).

The motor vehicle industry is currently investing major sums in researching the application possibilities of composites for the saving of raw materials and energy. Thus, Ciba Geigy in Basel is currently testing driveshafts made of composites. These composites were fabricated by using glass, carbon, and aramide reinforcements. Such shafts weigh only 3.5 kg to 5 kg (while conventional steel shafts weight 7 kg to 10 kg), and can transmit a torque of 20,000 Nm. Due to their good vibration resistance, the intermediate bearings and joints become superfluous so that the vehicle runs more softly and quietly.

In Europe, SNIAS has equipped 4,000 helicopters of the Gazelle type with vanes of glass fiber reinforced composite. The rotor of the helicopter Ecureuil (also from SNIAS production) likewise consists of composites and is twice as light, costs three times less, and consists of five times fewer parts than the rotor of the Alouette II helicopter. As a result, a five-seater helicopter like the Gazelle requires 30 percent less fuel and, in comparison to Alouette II, reaches a top speed of 260 km/h instead of 185 km/h.

Transporting natural gas by pipeline becomes more and more economical as the pipe pressure increases. An increase of the transport pressure with a simultaneous reduction of the pipe diameter and with the flow rate remaining the same would be advantageous. Here, the pipes would have to be wound in such a manner that reduced wall thickness - and thus less weight - would be possible. In this way, when the pipes are laid, the labor in welding can be reduced.

For at least 5 years, Spie-Batignolles and Coflexip have been involved in the development of sectional pipes, in which glass fibers are embedded in a thermoplastic resin. Such pipe sections are equivalent to steel pipes with a very high elastic limit, as far as their tensile strength is concerned. In fact they may even be superior. They also offer advantages as regards weight savings and corrosion protection, as well as significant savings with cathode protection; furthermore, they exclude the risk of longitudinal cracks at the interior walls of the pipe, which are caused by deformation and by brittle facture.

The present and future application possibilities in defense technology are so numerous that they cannot all be mentioned here. A noteworthy application, however, is the minesweeper Eridan. It was built by the French enterprise Constructions et Armes Navales de Lorient, as an initial exemplar, within the framework of a program comprising France, Belgium, and Holland. The fuselage, bridges, superstructures, and bulkheads of the Eridan were made with glass-fiber reinforced composite.

8348
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PECHINEY OF FRANCE TO PRODUCE LITHIUM-ALUMINUM ALLOY

Paris AFP SCIENCES in French 6 Sep 84 p 36

[Article: "Industrial Production of Aluminum-Lithium Alloy"]

[Text] Paris--On 5 September, the French group Pechiney, a leading world producer of aluminum, announced that it would start this month its industrial production of aluminum-lithium alloy, a material which makes it possible to reduce considerably the weight of aircraft.

By adding 1 percent of lithium, the lightest of all metals, to aluminum alloys, it is possible to achieve a 3-percent weight gain and a 6-percent rigidity gain. Replacing a traditional alloy by aluminum-lithium, it is possible to reduce the weight of an aircraft structure by 10-15 percent, according to officials of the nationalized Pechiney group.

For aeronautical engineering, weight savings will add up to tons for jumbo jets and long-haul aircraft. Now, for equal mechanical characteristics, any aircraft weight reduction will result in considerable fuel savings, an industrial source pointed out.

The first prototype intermediate products (rolled and forged parts) made out of this alloy were produced at the plants of Cegedur-Pechiney and Forgeal (another Pechiney subsidiary) in Issoire (Puy-de-Dome). The foundry production capacity is 1.2 tons per casting. Larger capacities are already planned to adapt production to the needs of the aeronautical industry, the same source indicated.

Research carried out by Cegedur-Pechiney, the group's subsidiary specializing in aluminum processing, had led in 1982 to the development of three new alloys of the aluminum-copper-lithium family, it was recalled.

In addition, prior to this production, the French Electrometallurgical Company (Pechiney group) recently achieved a first in France when it produced lithium metal in its Plombiere Saint-Marcel (Savoie) plant.

9294
CSO: 3698/63

PECHINEY, RHONE-POULENC GEAR UP TO ENTER FINE CERAMICS MARKET

Paris L'USINE NOUVELLE in French 4 Oct 84 pp 40-41

[Article by Philippe Lanone]

[Text] Confident about their know-how, Pechiney and Rhone-Poulenc fully expect to capture a part of the enormous market in fine ceramics, estimated at $19 billion for 1995. The first one intends to cover all fronts to seize its opportunity, and the second does not want to anticipate the evolution of the industry.

Because they can withstand temperature better than metals and because of their low thermal conductivity, enormous potential markets have been opened to fine ceramics, particularly for automobiles (high efficiency engines and the possible use of non-petroleum fuels). From laboratory curiosities only a few years ago, these compounds are beginning to reach an industrial stage. By 1995, they should capture a fabulous market of nearly $19 billion! Once more, it is the Japanese (Kyocera, TDK, Murata) and the Americans (General Motors, Ford, and so on) who have taken the lead in this field, with Europe so far being essentially absent from this market slot.

But this situation is changing. In France especially, two large chemical manufacturers have entered the game: Pechiney, through the creation of a "ceramics task force" in October 1982, whose direction was entrusted to Roland Cauville, current president of Criceram; and Rhone-Poulenc, through the launching of a "ceramics project" in July 1983, the leader of this strategic "task force" being Pierre Dessalos, assisted by Philippe Poirier, who provides technical direction.

It is logical for groups with such a prestigious past in mineral chemistry to have an interest in ceramics. Pechiney was already using similar technologies for refractories and carbon products. Its subsidiary, Howmett Turbine Incorporated, had also developed the fabrication of various ceramics to meet its own precision foundry needs.

Rhone-Poulenc, in turn, has long been a world leader in rare earths, some of which are finding applications in ceramics. Both groups thus had a background suitable for the development of fine ceramics. In both cases, this development was carried out under the care of those responsible for the industrial promotion of technical innovations: the new "metals and materials" branch at Pechiney, and the innovation directorate at Rhone-Poulenc.

Their task is not a simple one. While no one doubts the very promising future of these products, both groups agree in believing, as does Mr Cauville, that "we cannot say precisely what the technical ceramics market will be ten years from now." First of all there exists a "serious uncertainty about the date" on which these products will be developed; an uncertainty such that in 1983, the Japanese Association for Fine Ceramics was estimating that the world consumption of ceramics for engines by the year 2000, would be from 4 to 29 billion francs.

Although the "spread" is large, the figures themselves are enormous. It is however impossible to know at present which types of materials, or even which applications of these materials, will experience the greater development. "This translates into a large gap between the extreme values of forecasts for any given date."

As an example, for silicon nitride applications in automobile engines, Battelle Columbus predicts a spread of $0-90 million for 1990. Consequently, if technologic evolution favors this compound, its consumption could reach 90 million francs; otherwise, it could well be zero!

As Mr Dessalos observes, the market will likely orient itself toward "a competitiion among the various ceramics" for a given application. One must therefore not place any given product in the limelight at this time.

The market analysis of the two groups is therefore essentially identical. But their conclusions about the industrial strategy to be adopted are different. Pechiney's policy is to be positioned on all fronts so as to seize the opportunity, from whatever direction it may come, when the time is ripe. The group directed by Georges Besse wants to "be in the right starting blocks" for the beginning of the ceramics race at the end of the decade, in Mr Cauville's lighthearted word.

At the industrial level, this approach has led Pechiney to retain the "synthetic ruby of the Alps" department after the 1983 restructuring. Reborn as Criceram, its goal has expanded to the fabrication of special powders for ceramics, as raw materials for the fabrication of ceramic parts. The second aspect of this integration was the acquisition in May 1984, of a subsidiary of Lafarge Refractaires, Ceramiques Techniques Desmarquest. Pechiney also obtained a facility to produce ceramics for thermomechanical applications.

At present, Mr Cauville intends to diversify in the field of ceramics with applications in electronics, for which he is pursuing negotiations in France.

Pechiney will thus have achieved a technologic integration (the powders produced by Criceram will be used by the other companies) and will cover the market as a whole (it will produce ceramics for thermomechanical and electronic applications). In this field however, the competition will be worldwide. Mr Cauville therefore believes that he must also complete his geographical coverage. To this end, he is seeking cooperation agreements with foreign partners (particularly in the United States) that could range from simple licenses to joint ventures, and even to acquisitions.

Of these three aspects (market coverage, geographical diversification, and technologic integration), Rhone-Poulenc has retained only the first two. Indeed, Mr Dessalos defines only three jobs in the ceramics manufacturing chain: the chemist who manufactures the powders, the ceramicist who produces the parts, and the customer who uses them. For him, "these three jobs are totally different." Rhone-Poulenc has therefore chosen to limit itself to the role which it knows best, that of chemist.

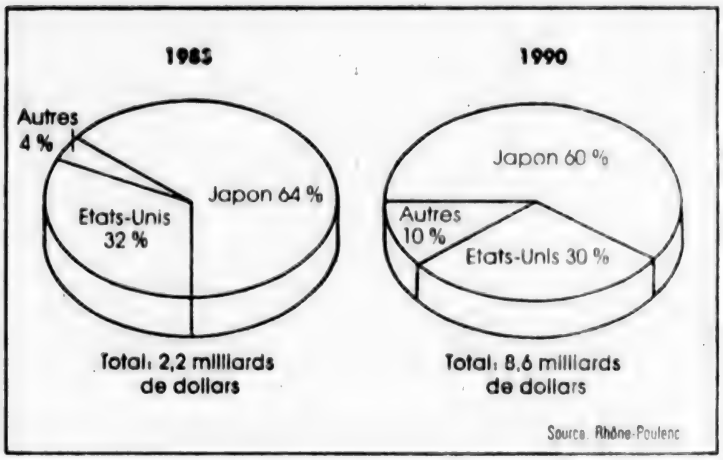
He believes in fact that there are as many chances for customers to integrate upstream as there are for chemists to diversify downstream. He thus deems it prudent not to anticipate the evolution of the industry: chemist, yes, ceramicist today, no. Rhone-Poulenc is apprehensive about the competition of customers. But Mr Dessalos does acknowledge that "overlapping areas exist between the activities of chemists and ceramicists. A certain competence in ceramics is needed to formulate powders." Hence the importance of applications laboratories.

As does Mr Cauville, the leader of the "ceramics" project at Rhone-Poulenc feels it necessary to develop international goals: "We cannot remain satisfied with the French market." He is thus seeking one or two foreign partners, particularly in Japan or the United States. Given the magnitude of the necessary investments, particularly in research and development, this market will be the exclusive bailiwick of the large industrial groups. As Mr Cauville accurately points out, "we cannot be satisfied with a sprinkling." Rhone-Poulenc as well as Pechiney know that their "place on the ceramics market will depend on the money spent today."

Powders for Ceramics
State of development of each company

	Zirconia	Alumina	Silicon Nitride	Barium Titanate
Rhone-Poulenc	Industrial	R&D	R&D	Pilot
Pechiney	Industrial	Industrial	R&D	

World Consumption of Fine Ceramics
in 1983 and Forecast for 1990



Distribution of consumption in 1990 will be approximately the same as today (with Japan in the lead) but the total market will be 4 times as large.

11,023
CSO: 3698/29

RENAULT TO HAVE IN-HOUSE FACILITY FOR SILICON CARBIDE, SIALON

Paris L'USINE NOUVELLE in French 4 Oct 84 p 41

[Article by Pierre Laperrousaz]

[Text] It is almost an accomplished fact, in the form of a research and development center combined with a pilot plant. The new installation will allow Regie Renault to integrate ceramic parts into its engines.

The rumor was already several months old, that Renault would buy Ceraver's thermomechanical activities. Today, that has been done--or nearly--following the official announcement that the group would create an installation at Tarbes. All it needs is an approval from Renault's Central Establishment Committee and from the Board of Directors. A company will be created under Renault's leadership, with French and foreign partners. The American Carborundum has been mentioned among others, but has not been confirmed.

The new installation will assume the form of a research and development center combined with a pilot plant, corresponding to an investment of about 100 million francs. The center will employ about 50 people, five of them engineers from Ceraver. But according to a Renault spokesperson, 60-80 employees (Renault personnel and new hires) should join them very soon.

For Renault, the decision to invest in ceramics follows the course of history. The integration of silicon nitride and carbide, as well as zirconium and aluminum titanate parts is no longer a futuristic speculation. It will happen very soon, and automobile manufacturers should master the industrial fabrication of these parts, with raw material manufacturers limiting themselves to supplying the powders. But while the Renault laboratories were already very active in research and development, they were forced to sub-contract the fabrication of parts (firebreak plates, exhaust pipes, cylinder tops, and so on) to ceramicists.

At Ceraver, the operation corresponds to a refocusing. In recent years, the company had invested tens of millions francs in the development of thermomechanical ceramics (silicon carbide and sialon). Faced with the impossibility of sustaining such a financial effort for much longer, it

preferred to turn over its valuable know-how to a group sufficiently powerful to develop it. Moreover, after the unfortunate Eurodif operation, it was afraid to enter a market in which it would have once more been at the mercy of a single customer.

Efforts on Products With More Diversified Outlets

That is why Ceraver decided to concentrate its efforts on products whose industrialization is already more advanced and which have more diversified outlets: micro- and ultra-filtration alumina membranes, translucent alumina, and so on. The company will implement a restructuring plan for the 1984-1987 period, with a financial budget of 140 million francs, of which 58 million for investments, with the government contributing 32 million.

At the present time it is not yet known whether the new company controlled by Renault, bought the Ceraver catalyst support (corderite) technology for catalytic converters, but it probably did. The question is an important one: the predictable explosion of this market following the adoption of the new no-lead gas regulations, will be a good source for financing the expensive research that remains to be carried out before industrializing thermo-mechanical ceramics for engines.

11,023
CSO: 3698/29

FRENCH, UK, SWEDISH RESEARCH IN POWDER METALLURGY, HIP

Paris L'USINE NOUVELLE in French 18 Oct 84 pp 111-113

[Article by Dominique-Marie Benasteau: "Powder Metallurgy: A Display of Processes"]

> [Text] The abundance of new techniques promotes the awareness of the potential offered by "powders" and their applications. And, far from competing with one another, these techniques prove complementary.

To speak of non-traditional forming processes in powder metallurgy--the subject of the fall symposium of the French Metallurgical Society--implies that some traditional processes exist. For most French engineering and design departments and industrial designers, this may be a prediction rather than an observation.

At any rate, the abundance of new techniques currently tested by researchers in British, Swedish, Swiss, German, U.S.... and French labs can only promote a significant awareness of the potential of "powders" and their applications. And, far from competing with one another, these techniques turn out to be complementary with respect to the shapes, sizes and series of parts that can be made, and the nature of the alloys used. This rediscovery of powder metallurgy starts by leaving behind two preconceived ideas that hinder its development. On the one hand, filter manufacturing, in itself very efficient, vehicled the concept of a porous product, which could not be very attractive for mechanical parts. On the other hand, the superalloy-isostatic pressing alliance, of which aeronautical engineers are so fond, gives all these technologies an aura of costly sophistication. Between these two extremes, the middle road: powder pressing followed by sintering, to which most precursors and advocates of powders confine themselves (at least in France).

Apart from these cliches, however, there are many processes which make it possible to use powders to produce parts which are economically as well as technically efficient. First asset: the addition of constituents that would be hard (or impossible) to mix in a molten metal bath. At the Voreppe research center of Cegedur-Pechiney, the goal was to make all-aluminum engine liners, dispensing with the cast-iron liner, the traditional solution that was somewhat "heavy" in every respect. Cold pressing of an aluminum-graphite-silicon

mixture followed by extrusion of the billet will yield a 100-percent dense product which is heat treated before being cut and machined. The liners thus obtained showed no tendency to seizing. A first, people at Voreppe believe. Indeed, seizing, which occurs in particular during cold starts, had until now been the major problem with all-aluminum engines and hindered their development. Powder metallurgy could revive interest for this solution whose advantages, linked to the high heat conductibility of aluminum, are undeniable (increased power or reduced overall dimensions, depending on the model).

There is another difficult association in the field of high-speed steels, in which atomized powders were already used, although not commonly used. But the traditional techniques imposed composition limits (for vanadium, tungsten and carbon for instance). The laboratory of the Saint-Etienne National Advanced School of Mines revived the idea of mixing steel powders and carbide powders (vanadium, tungsten and titanium) which are formed simply by hot hammering. The best composition turned out to be a mixture of high-speed steel (the 6-5-4 well known of machine-tool operators) and 2 to 10 percent by weight of vanadium and tungsten carbide. The material obtained offers appreciably improved hardness and wear resistance, with respect to both traditional high-speed steels and atomized and sintered powders.

Ceramics, Too, Benefit From These Technologies

Powders can be used only on the surface; this is the road explored by the Lyons School of Engineering and UNIREC [expansion unknown]. For shaped parts designed to withstand severe abrasion or corrosion conditions, manganese steel and chrome-molybdenum alloy cast iron are sometimes replaced by an ordinary steel part "refaced" with one or several layers of alloy steel, which reduces the cost. With powder metallurgy, it is possible to obtain layers about 10-mm thick in one pass. All you have to do is place small sintered powder plates in a mold in which the substrate steel is then cast. Abrasion-resistance tests have yielded encouraging results, although the nature of the facing still has to be optimized. Wear is usually less than in chromium cast iron and, in the case of the samples with the highest manganese and chromium contents, resistance is said to be superior to that of Hadfield steel.

Another type of hard-to-shape materials, ceramics, can also benefit from powder-metallurgy technology. At the ceramics laboratory of the Lausanne CEPF [expansion unknown] , Mr Mocellin even suggested to induce superplastic deformation in certain ceramic compounds. Deformation rates of several tens of percentage points would renew the range of shapes that can be made. This is the case for uranium and boron oxides, silicon carbides as well as hard magnetic oxides whose energy products (BHmax) turned out to be more than doubled by this forming method.

At the Louvain Catholic University, in Belgium, attempts to produce memory alloys from water-atomized powders have given promising results. Still faithful to the Proteus alloy line, which has already found interesting applications in the fields of safety and heat regulation, the compositions tested were ternary copper-zinc-aluminum alloys. Their forming through uniaxial compaction or isostatic pressing yielded products with a very fine and homogeneous structures. Hot rolling is mandatory in making parts, to break the

alumina layers between particles. The mechanical properties thus obtained are more uniform and the memory effect more powerful. As for amorphous alloys, research made at the Nancy University indicate that powder metallurgy could give them a "third dimension." For, although they can be made into strips and plates, these products are not suitable for all applications. A number of forming processes were tested, some traditional, such as hydrostatic or uniaxial pressing or hot extrusion, others more innovative and dynamic, such as impact-wave strengthening, flash sintering, etc.

Also for somewhat special materials, plasma-torch projection in a controlled atmosphere or under partial vacuum makes it possible to produce high-density high-purity coatings, even in the case of air-reactive alloys. The cost problem still has to be solved.

Forming Through Pulverization: Several Processes

A somewhat similar approach caused the Swansea University, in Great-Britain, to consider several pulverization-forming processes. Noting that traditional powder metallurgy was well suited to produce complex small-size parts (usually less than 1 kg), the British researchers, on the contrary, chose as their objective the sector of simple, large-size parts and, since the technique was of a rather continuous nature, products such as tubes, billets, etc. Four variants were more closely researched. The older one is probably pulverization on a rotating support, which yields a strip 1-mm wide or more (up 18 mm for aluminum alloys). The rapid solidification of each particle on the substrate prevents any segregation, so that the product was used for silicon steels. GKN Vandervell just started producing "mixed" steel-aluminum bearings for the automobile industry. A single combined operation makes it possible to produce a strip of aluminum alloy by pulverization and weld it to a "reverse" made of steel. Another development is forging-pulverization, which is commercially used by Osprey Metals. The preform, which this time is obtained by a deluge of particles, is porous and receives its density through forging. The fine-grain structure of the first stage is retained and the resulting forged part is far more isotropic than with traditional processes. At Swansea, this approach--called pulverization casting--was recently resumed to produce preforms rather than parts. Two variants exist: projection on a mold that is the reverse replica of the shape to be obtained; or moving the jet on a flat support. It is possible not to use gas for pulverisation by using the centrifugal force. Small tubes made of aluminum alloy and also of an alloy with high nickel and chromium contents (Nimonic 80A) were obtained using the Harwell centrifugal machine. Before filing for bankruptcy, Aurora Steel had launched a larger-scale program on tool steels. Bars, sheets and forged parts had been obtained with zero segregation and characteristics comparable to those obtained with hot isostatic pressing. At lab pilot-scale, coating by pulverization has already shown the interest of this technique to form thin layers (zinc-aluminum or combination). Its assets: treating at will one face or two with thicknesses than can easily be varied. The sheets thus treated can be stamped without any damage or any risk of breaking the protective layer.

These processes, going directly from the molten metal to products in a single stage, are not the only ones calling for a liquid phase, an incongruity in

what is called "powder" technology. The materials department of the Paris National Advanced School of Mines has experimented various processes for superalloys and light alloys. Natural sintering, without any facing application, cannot eliminate porosities, which must be evacuated by isostatic pressing (without any container, since work is done on a preform) or by forging. Another method consists in applying a stress to obtain directly complex-shaped parts. The importance of the liquid phase can reach 30-40 percent. Industrially, the problem does not lie with the application of pressure, which remains moderate, but with its duration (a few minutes to one hour). The problem of selecting an inert, low-cost, stable, etc., material for the forming mold has not yet been solved in the case of superalloys. For aluminum bases, the container is not a problem.

The combination of powder-metallurgy processes and traditional forming operations is also illustrated by the sintered-forged material used at Renault to make transmission gears. Located in Cleon, the production line is fully automated, and the part characteristics (toughness and fatigue strength) are easily equal to those of the machined versions. The cycle includes powder mixing, compacting of the rough part, followed by sintering and, finally, heating and forging. The average production rate is 1 part every 10 seconds.

Hot Isostatic Pressing Becoming More Common

For their part, the more traditional powder-metallurgy methods are broadening their potential range. This is the case, in particular, of hot isostatic pressing (HIP in Anglo-Saxon countries) which tends to become more common. A study of the Atomic Energy Commission at Bruyeres-le-Chatel revealed many improvements in presses: more rapid pressurization of containers, but also accelerated cooling (cooling time divided by a factor of 6 to 8) and the feasibility of other treatments prior to the pressing treatment proper. In particular, sintering under vacuum or elimination of the compacting binders. The use of processes related to plastics injection and providing the same freedom in forms appears already interesting in itself. But the cost barrier still has to be overcome, according to My Hanh Technology, in the United States. The most promising metals are stainless or heat-resisting steels, aluminum or titanium alloys, as well as composites and pseudo-alloys, ceramics, etc.

In Sweden, Asea shows considerable interest in the association of injection molding and hot isostatic pressing, as the container--obviously an additional cost--is then superfluous. High-strength parts, such as gas-turbine disks, gave full satisfaction, especially with respect to density and precision (over 200 microns on 100 mm). To overcome the cost barrier, Asea is orienting itself toward materials with a high basic cost (high-strength stainless steel) and intricate parts, preferably in larger series.

The same problem occurs in cold pressing. In Sweden, CIPS [expansion unknown] is using "tool cassettes" that can be changed rapidly and produces large series of parts weighing from 100 g to 10 kg at the rate of 120 cycles per hour. At Legrand SA in Limoges, uniaxial compacting is assisted by ultrasounds. Gains are made on the product (less intense stresses), on tools (simplified design thanks to ultrasonic ejection) and on equipment (identical densification obtained with less power).

Cold isostatic pressing can also be complemented by other deformations. For instance, the process developed by Nyby-Uddeholm and used by its joint-subsidiary with Vallourec. Austenitic stainless-steel tubing for deep and corrosive oil wells is obtained from prealloyed gas-atomized powders that are containerized, compacted at 5,000 bars and hot drawn. In this case, characteristics equivalent to those of traditional products are obtained with great flexibility. Small batches and short ordering times are no longer a problem.

Powder metallurgy, which still has many surprises in store for us, prefers sometimes large series, sometimes small series, and, depending on the process used, is applicable to simple or complex shapes, to parts produced "to final dimensions" as well as to intermediate products.

9294
CSO: 3698/63

FRG WEIGHS ESA PARTICIPATION, BUDGET ISSUES

Duesseldorf HANDELSBLATT in German 10 Sep 84 p 10

[Text] Bonn--Since 1 September Professor Raimar Luest has been heading the European space organization ESA (European Space Agency), the first German to do so. Under his aegis the course must be set for European space operations for many years to come. And this must be done very soon. Because the Europeans must decide in the very near future whether or not they want to take part in the construction of the large American space station initiated by President Reagan. The decision is supposed to be reached here between the middle of January and the end of March 1985 at a session of the ministerial council of the European Space Agency ESA.

Another important decision now pending is the construction of a large rocket suited for manned space travel, the so-called Ariane-5. Both projects have to do with sums in the range of about DM 5 billion each, according to rough preestimates. But what are the prospects in connection with European finances? How do European space expenditures compare today with those of the Americans? The figures are sobering.

Space Research Totals 11 Percent

The federal minister for research and technology, Dr Heinz Riesenhuber, has pointed out that already 11 percent of his budget is being put into space research. It is true that now some funds are likely to be freed up since the capital expenditures for certain major projects--such as the manned European space laboratory Spacelab and the large rocket Ariane--have been effected already. But Riesenhuber pointed out on 29 August in Bonn that these funds being released are already budgeted largely for specific space projects, such as for the European space platform "Columbus," for example.

But what is the situation now with respect to the costs and needed capital expenditures for space operations? The United States is investing almost four times as much as the Europeans in space travel, namely (in the civilian and military sectors) $15 billion annually. Just the 1983 NASA budget alone amounted to $6.77 billion, and is to be increased in 1984 and 1985 by between 25 and 40 percent. As early as in 1974, Japan was already spending more for space operations than the FRG.

At the present time the West European states are investing a total of only about DM 4 billion annually in space operations. Currently the FRG, with about DM 800 million, has outlays considerably below the capital expenditures of Japan and roughly only around half of the sum which is being provided by France. (Here one should realize that the half of the sum of DM 2 billion which was paid by the FRG for the 10-year development of "Spacelab" saddled the FRG citizen with only DM 2 annually).

ESA Dream Budget far Below NASA Costs

In any case, participation in the U.S. space station, the Ariane-5, and other projects would necessitate a considerable increase in European funds for space operations.

In order to estimate the future financing needed, the economic prospects, and the likely sectors of technological development for European space operations, Prof Ruppe of the University of Munich has drawn up a dream budget for the ESA. But here one must first realize that in 1983 the ESA had a budget of only $850 million, compared to the $6.77 billion of NASA.

By 1985 the ESA dream budget should amount to about $1.2 billion already and increase annually in real terms (that is, after adjusting for inflation) by 3 percent. In that case, by the year 2030 it would be at $4.538 billion and thus still smaller than the NASA budget is today. If this financing could be managed, then between 1985 and 2030 the ESA would have available to it about $115.8 billion. How these amounts could be used appears as follows in Prof Ruppe's planning:

	Billions of dollars
30 % for hardware purchasing, in-house ESA operations	34.74
30 % for payload purchasing/individual payload development	34.74
25 % for technology developments	28.90
15 % for development of the program material for the hardware	17.37

Capital expenditures for technology developments are detailed as follows, in billions of dollars: Booster rockets (Ariane-5, ETS 1 to 4)--6 billion; thrusters--2 billion; launch-pad infrastructure--2 billion; space vehicles (ballistic, Hermes)--5 billion; EURECA and so forth--1 billion; modular satellites--0.5 billion; upper stages--2.5 billion; electric drives/aircraft--2 billion; solar sails--0.5 billion; orbiting operations--1 billion; space station (Mk 1)--2.5 billion; manned outer-space operations-- 1 billion; secondary developments--1 billion; 7 percent for reserves--1.9 billion. Within a period of 46 years, this amounts to $28.90 billion.

Increases Scarcely Feasible

The following formula could be viewed as realistic as an apportionment of this dream budget among the European countries: Belgium 3 percent, Denmark 1.3 percent, Germany 25.85 percent, France 27.8 percent, Great Britain

15.15 percent, Ireland and others 0.75 percent, Italy 10 percent, the Netherlands 2.75 percent, Sweden 2.75 percent, Switzerland 2 percent, Spain 2.7 percent, special allocations 6 percent. Thus the dream budget for the ESA presupposes on the whole a raising of the national astronautics budgets of the countries concerned by about 50 percent.

It must be questioned whether at the present time such increases can be implemented in Europe. But on the other hand, despite all reservations and qualifications it is certain that Europe must increase its capital expenditures in the field of space operations. Because today developments are already under way which perhaps could give new life to the old slogan of the "usefulness of space operations." For example, already the 3M concern (Minnesota Mining and Manufacturing Company, 86,000 employees in 53 countries, annual sales in 1983: $7 billion, research expenditures in 1983: $300 million) has entered into an agreement with NASA for using the space shuttle for research of interest to industry (thin-layer films, large crystals for the semiconductor industry, and so forth). NASA is already moving the firm's employees so that the company can conduct its own investigations in space. And the respectable American technical journal AVIATION WEEK has already predicted that as early as at the turn of the century, sales amounting to billions of dollars are likely to be achieved with drugs manufactured in space (interferon, hormones, insulin, and so forth) as well as other space products. Now it certainly remains to be seen whether such optimistic prognoses will be fulfilled. But it also seems certain that Europe should not completely ignore this newest development. That has been recognized and voiced on this side of the Atlantic above all by French President Francois Mitterrand, who moreover also consistently supports a manned component in European space operations. But Europe must not take its further steps into manned space operations too very naively, as with Spacelab. There must not be a blanket "green light" on European-American cooperation, as is being sought for understandable reasons especially by foreign-affairs politicians who have little idea of internal space operations affairs.

Decisions Are Pressing

But however the European share in the American space station may appear if the occasion arises, it is certain that the governments of the 11 ESA member states must make their decisions for or against such cooperation in the coming weeks.

In Bonn, the decision is supposed to be reached in October/November. In this connection, based on the sweeping promises by Federal Chancellor Kohl to President Reagan it is true that scarcely anybody is still reckoning with the possibility that the Federal Government will reject the project. But it remains undecided how participation in the U.S. station, which is being characterized in scientific quarters as too expensive and not sufficiently promising, is to be paid for. An increase of 50 percent in the German 800 million space budget seems unavoidable. Already Riesenhuber is having his ministry combed in order to track down possibilities for economizing. Scientists are already warning that German research is likely to suffer grievous damage if additional monies are not appropriated to the

research minister for the space station project. And already the research minister himself has warned: "What our participation in the space station means economically for the near future can be easily summed up: Namely, nothing at all."

Nevertheless in Bonn Riesenhuber has now very cautiously come out in favor of cooperation on the station. "If manned space travel may ever take on any importance at all--and I cannot rule this out--then we are now at a fork in the road," he said. "Either we are now one of the party. Or we will be outside for a long time."

But Riesenhuber also leaves no doubt that he considers the earmarked high German and European capital expenditures in the U.S. space station to be a good and proper proper thing not only for technological but also for political reasons: "If one views it as reasonable to concentrate in one spot the certainly generally divergent technical developments within the Western World, then there are not very many alternatives to the space station project: It is very large. It needs the contributions of all. It demands diverse technological competences. It represents a cross-section through a very great number of technologies. And it is site-independent."

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AEROSPACE

DFVLR STUDY RECOMMENDS EUROPEAN INDEPENDENCE IN SPACE SYSTEMS

Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German 27 Aug 84 p 3

[text] For the continued future development of European space travel, the German Research and Development Institute for Air and Space Travel (DFVLR) is recommending both the construction of the European Ariane 5 booster rocket and participation in the construction of an American space station. The DFVLR is further proposing that the FRG should participate in the development of serviceable platforms with manned space station elements. The development of the RM 60 rocket engine is recommended as part of the Ariane program, which will give the planned Ariane 5 rocket so much thrust that it can put a European space ferry into orbit around the earth. This emerges from "Space--A Strategy Study" by the DFVLR, which the Institute recently presented to the government.

In the opinion of the DFVLR, the so-called "grand scenarios" for European space travel which include an unmanned recovery system to supply space platforms, serviceable equatorial and Polar platforms, in addition to the Ariane 5 and a European space ferry (Euro-Shuttle), are twice as high in their development costs as the other space scenarios investigated.

According to the Institute's estimate, European countries must be independent in the transport system mainly for the economic use of space. That could be possible after another 10 years of further development. If no suitable booster system were to be available for these tasks at the end of this time, Europe would lose 15 to 20 years in technical development; the reason given by the DFVLR is also that there will be a lack of development capacity in later years if the continued development of existing projects were broken off now. In the view of the DFVLR, the Ariane 4, whose development will be completed in 1986 and will cost a total of DM 5.6 billion at today's value, would not be competitive with the American shuttle as a transport system for projects in space, either technically or in price.

An additional argument for independent European efforts is the fact that the development of a European launching system will have a positive influence on American pricing: even the increased prices for shuttle use that come into

force in 1986 will not cover the actual operating costs by far, according to figures from the DFVLR, but are oriented to the Ariane launching prices for geostationary satellites. Even following additional transportation cost reductions as part of the space station plan, the operating costs of the American system in the future would still not be belows the costs of the planned Ariane 5, says the DFVLR. If the Americans were to decide just the same to undercut the Ariane's launching costs, the Europeans could benefit from a pricing policy of this kind.

The DFVLR holds the following views on the technical aspects of European space travel in the future:

No spectacular developments are anticipated in satellites and probes. A strong increase in peformance in data processing and data storage in the satellites themselves can be expected. Further possibilities for development in future satellites are limited primarily by the weight limitations of the existing shuttle and/or Ariane launch systems.

Serviceable Platforms Offer Many Advantages

Serviceable platforms on Polar and equatorial orbits could offer better prospects for the future. As far as possible, unmanned space vehicles and teleoperator systems would have to take over the maintenance, repair, supply and load configuration as far as possible. The DFVLR estimates a development time of 6 to 7 years, with development costs of DM 0.8 billion for platforms in equatorial orbit and about DM 1 billion for Polar orbits; the lower expenditure for equatorial orbits is based partially on the fact that the rotation of the earth can be used to assist the launch, so that an equal effect can be obtained with lower performance from the rocket.

Serviceable platforms offer substantial advantages: the assembly of larger instruments in orbit would be equally as possible as the readjustment of measuring instruments and fabrication installations. Instruments in space could be used longer, if the supply of consumable items such as helium, film and filter material could be renewed on serviceable platforms. Instruments in space could be adapted to technical progress and changing objectives through the occasional replacement of instruments.

Besides serviceable platforms, thought could be given to manned European modules, which would offer the possibility of free flight and also docking with an American space station. The DFVLR estimates the development time for a laboratory module at 7 to 8 years, with development costs of DM 0.75 billion. A more complex supply module would require 10 years development and could at least DM 1.25 billion. A manned European space station would be considerably more complicated than a laboratory module and it would probably be rejected because of costs. Its development time would probably be 10 years and consume DM 7 billion in development costs.

The above mentioned umanned supply platform would be needed to link permanently serviceable platforms with the shuttle, the space station or an independent

recovery system. Its development time is estimated at 7 years, its development costs at DM 1.2 billion.

Still No Joint Design for Ariane 5

Further possibilities for European space travel are heavily dependent on the availability of appropriately powerful transport systems. As the DFVLR writes, the American space shuttle is clearly less expensive than the European Ariane 4 rocket for transportation in low orbits. With larger payloads (more than 6 tons), only the American shuttle can be considered anyway. This is reversed for higher orbits, because the satellites launched from the American shuttle require additional transfer propulsion like the Inertial Upper Stage (IUS). Here the Ariane 4 is more cost effective, within the limits of its payload capacity. Only the American Titan and STS rockets could bring payloads of more than 2.5 tons into high orbits.

The DFVLR states that for large geostationary satellites with payloads of 4 to 5 tons the availability of a powerful European booster system is desirable, as represented by the planned Ariane 5. It is supposed to be capable of putting 4- or 5-ton payload into geostationary orbit, or 15 tons into low orbit. But no agreed upon design yet exists among the European partners. Development costs of DM 6 to 8 billion have to be expected. In addition, there would be launching costs between DM 150 and 200 million for the Ariane, which is considered competitive, compared to the American STS rockets. If the transportation system were manned, development costs would rise to between DM 7 and 9.5 billion. A project decision about the engine for the Ariane 5, the HM 60 rocket engine, is to be made at any time.

For the event that platforms are built that are not accessible from a shuttle, an unmanned recovery system (an automatic service vehicle) will be necessary. The DFVLR is positing a development period of 10 to 12 years and development costs of about DM 1.5 billion. In the opinion of the Institute, a European space ferry with a payload of 1.5 tons will require a development time of 10 to 15 years and would cost an estimated DM 5 billion.

The construction of space equipment is not enough by itself. For data radio traffic both a data relay satellite system as well as the corresponding ground installations would have to be built. The Americans already have a powerful system with their TDRS (Tracking and Data Relay System) satellites, but the user fees are considered quite high in the eyes of the DFVLR. An autonomous European system would require development time of 6 years and, with two satellites in orbit, would cost DM 1.3 billion (or DM 2 billion with three or four satellites, as is considered necessary for manned missions).

Extensive ground facilities would have to accompany the space projects. They include the mission control center, the payload control center, test and simulation installations, launch facilities and, if required, landing sites.

As the DFVLR describes it, the principal areas of application for space travel in the future are extraterrestrial research, observation of the earth, bio- and material science, telecommunications and some "exotic" programs such as the

elimination of nuclear waste and an energy generating station. In the case of observation of the earth, it can be anticipated that conventional satellites will be ousted by serviceable, polar orbits. Polar orbits, in contrast to equatorial orbits, cover the entire surface of the earth. High orbits are interesting for weather observation and oceanography, while low orbits are important primarily for land observation and reconnaissance. According to the DFVLR, German wishes are concentrated on better ground installations. Better ground installations are also needed to prepare, file and refine the data received, which is in image form, for cartography and land use. Suitable sensors are currently under development in the FRG, whose use for space travel is also to be marketed at a later time. The FRG is not presently participating in plans for military reconnaissance. But after 1990 a division of labor as part of the military alliances can be expected. The report says that Europe will have to ensure immediate access to information through its own reconnaissance system.

Bioprocesses Require the Presence of Man

Efforts should be made initially to utilize the spacelab as frequently as possible and later the reusable platforms in bioscientific and material-scientific projects exploiting the almost total lack of gravity (microgravitation). Permanently manned modules for these tasks should also be made available as soon as possible. Viewed over the long term, the DFVLR believes, a shift to biotechnical and material-technical production can be expected. In the biosciences, the study of the ability of microorganisms from earth to survive in stages of dormancy under the influence of the factors of free space and the search for prebiological and biological material in free space and on other planetary bodies are of preeminent interest. In the view of the DFVLR, the complexity of most of the biological questions excludes the complete automation of experimental installations. Experimental work and the care of cell cultures, plants and animals require the permanent employment of human beings.

After biotechnical experiments on board an American space shuttle showed a remarkable increase in the effectiveness of the separation of organic material with the help of electrophoresis, new expectations were aroused in this area. This also applies to the possibility of achieving better fusion of cells in space, which should then have completely new characteristics. Interest is also turning to obtaining urokinase from kidney cells. This enzyme can dissolve blood clots. But it exists only in extremely small amounts and, if at all, can be had only at very high prices. A few years ago, American scientists determined that 50,000 to 60,000 lives could be saved each year, if this enzyme were available. Beyond this, doctors hope that erythropoietin can be succesfully manufactured in space from kidney cells, which promotes the formation of red blood cells in bone marrow (an agent for used in the case of illnesses of the kidney). It is expected in addition that lymphocytes and lymphocyte products, which are responsible for the immune reactions to foreign matter (bacteria, toxins, transplanted organs), can be manufactured in orbit. And finally, the derivation of new antibodies by cell fusion could be a rewarding project.

Within material research, interest is turned to application-oriented basic research. For example, there is hope of discovering new knowledge of how the controlled freezing of metals proceeds. In addition, products for scientific purposes can be manufactured, including protein crystals, so that their structure can be studied. Experiments in space should provide information about basic phenomena, so that processes on earth, for example, pneumatic delivery technology can be improved; Bayer AG has already carried out work in this area (SPAS-01). The MAN company carried out research in the areas of structural skin technology and pouring schlich. In its study the DFVLR also mentions the possibility of creating standards of comparison as a result of processes in space. The manufacture of mass products, such as steel and semiconductors, could be improved on a selective basis as a result. However, the DFVLR does point out that the only commercial product from space so far has been monodisperse latex beads for calibration in microscopy.

Improving telecommunications should be economically more promising. It is already a billion-dollar business for the United States. According to the DFVLR's account, an annual market volume of DM 1.1 billion for satellite and Ariane rocket launches exists in Europe. The Institute is assuming two geostationary satellites and six Ariane launches each year, whose costs are already being borne totally by the market. The expectation is for market volume to double by the end of the century, with about six satellites annually and correspondingly more rocket launches. There is also the hope of marketing launches for other countries' satellites. The expectation here is about 6 launches in 1985 and an increase to at least 10 launches in 1995. An average satellite today costs about DM 250 million, and its launch with Ariane an additional DM 100 million, the DFVLR reports.

European space experts expect that the need for satellite communications will grow considerably in the next few years. The volume of conventional communications will grow primarily in the less industrialized countries and in new mobile telephones. The share of satellite transmission in long-distance communications networks will grow. The construction of networks serving wide areas for new broad-band services, such as digital business communications (speech, image, text, data), including video conferences and television distribution will require increased performance from the communications satellites.

Electronic Technology Must Continue to be Developed

The continued development of satellite communications presupposes considerable technical efforts. The geostationary orbit at just under a height of 36,000 km is already saturated with satellites in some parts, and for reasons of accuracy in direction finding and clean separation of signals they have to maintain certain minimum intervals. At the very latest when the orbit is fully occupied, new frequency ranges will have to be made accessible. A higher capacity could be achieved by means of better use of the band widths, by improved modulating methods, increased noise immunity, more efficient access methods and bandwidth-saving coding procedures. Another way would be multiple occupation of the frequency bands through the use of highly concentrating antennae on the ground, improved precision in maintaining the satellite's

position and the development of sharply focussing phase-array antennae with a high degree of purity in polarization. New TV satellite antennae with an adaptable ground contour could also be developed, which would contribute to an improvement in performance. Deployable parabolic antennae with multiple input feed to create electronic regions (cells) on earth could also be developed.

The shortage of satellite locations could possibly lead to the necessity of installing antennae "farms" on large platforms. It is also conceivable, that satellite clusters would have to be formed. With the aid of laser beam data transmission, multiple hops through intersatellite links could be avoided. Furthermore, satellites that had become unusable would have to be removed from geostationary orbit. Finally, data procession on board the satellites themselves would have to be improved; this includes demodulation, interim storage and precise data transmission. To a large extent, earth simulation installations can be used for the continued development of communications satellite systems; newly created pieces of equipment need only checked for their suitability on test flights before they are installed in satellites.

The DFLVR numbers the construction of navigation systems among the additional tasks of space flight. Today there exists the GPS [Ground Processing System] Navstar system of the U.S. Defense Department. In times of crisis its use by civilians would not appear to be assured. The FRG will most probably be forced in the next few years to set up a compatible system for civilian traffic (with or as part of the Inmarsat [International Maritime Satellite] projects), in the view of the DFVLR. Inmarsat is already operating a navigation and data transmission network using satellites for a large number of countries.

Photo caption.

The objective of European desires: their own space shuttle? Only those who face this competition can profit from space travel. Observers fear, however, that the Americans will not offer their transportation system so generously for other countries to use, that serious competitors could come into existence looking for economic advantage, not to mention questions of military power. This will have to be respected, because, after all, the United States spent billions of dollars to gain this technological lead. But access to space travel and the future markets that depend on it must be free, so that important industrial nations do not lose contact with technological development, which must safeguard their future existence. Access to space travel must not be under the control of market competition. From today's point of view, Europe has scarcely any other choice than to continue development of its own transportation system. The photograph shows the launch of an American space shuttle. The Europeans would not be able to reach this stage until after decades of intensive development work.

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ASTRONAUTICAL CONFERENCE HEARS DETAILS ON HERMES MINISHUTTLE

Paris AFP SCIENCES in French 11 Oct 84 pp 16-18

[Article: "If Need Be, Hermes Will Land on Standard Runways"]

[Text] Lausanne--The European minishuttle currently designed by scientists and engineers at the French CNES [National Center for Space Studies] should be able to land on any standard airport runway 3 to 3.5 km long, Mr Jacques Simon, of the CNES subdirectorate of programs and future missions, indicated at the International Astronautics Congress.

According to Mr Simon, "the normal landing site of Hermes will be Kourou, in Guiana, from which it will be launched by the Ariane-5 launcher, but we are considering the feasibility of having it land directly in Europe; why not at Istres or on a runway in southern Spain?"

Hermes will have a takeoff weight of 16 to 17 tons (compared with close to 100 tons for the U.S. shuttle), and it will carry only 4.5 tons of freight with a crew of 4 to 6 cosmonautes (compared with some 30 tons and 7 astronauts for the U.S. shuttle).

However, for man's future operations in space, when permanent space bases are available, "there will be room for minibusses next to space trucks."

French experts also expect that Hermes will be able to dock to the future U.S. space station as well as to Saliout-type or other Soviet orbital stations.

"We asked NASA to provide a special Hermes docking station on the future space station, and the Americans are ready to receive Hermes," Mr Simond told AFP. "For that," he added, "an interface part will have to be adapted to the shuttle with a connecting tunnel corresponding to that of Hermes."

In other words, in a way, the station would be equipped with "visitor parking" providing compatibility between the various space transport systems.

The French experts have now completed the preliminary typing of Hermes. The decision in principle to launch this program, whose cost is estimated at FF 8 billion for research and development, if it is approved by the European partners, should be made late in 1987 or early in 1988 for an initial 1997

launching, i.e. two years after the first launchings of the Ariane-5 rocket that will be capable of placing on orbit weights equal to that of the minishuttle.

J.C. Cretenet, engineer at the CNES launcher department, indicated for his part that the Hermes space vehicle will have an overall length of 15 to 18 m, a height of 6 m and a wingspan of 10 m.

The astronauts' cabin will have a volume of approximately 15 m^3 and a 35-m^3 bay with a total diameter of 3 m. When launched, Hermes will fit entirely under the nose of Ariane-5. It will therefore not be seen at the time of launching.

However, it will return as a genuine space glider; it will have only tiny engines to orient itself in space and provide the braking power required to get off its orbit. All the same, there will have to be 2.5 tons of propellant on board to fuel them.

The manned orbital vehicle Hermes, "developed in a European context or through cooperation between Europe and the United States," Mr Cretenet pointed out, "should constitute an essential part of the European orbital infrastructure which would eventually become independent." Besides, this infrastructure should also include automatic or manned orbital stations and platforms.

With this prospect in mind, Europe is already working on projects called "Eureka" (space platform for science and technology) and Columbus, a spinoff from the first U.S. laboratory in space, Spacelab.

Because of their dimensions, Eureka and Columbus are expected to be placed on orbit by the U.S. space shuttle. But once in orbit, they could form independent systems.

9294
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SWEDISH SPACE PROGRAM INCLUDES RESEARCH SATELLITES

Stockholm MANADS JOURNALEN in Swedish Oct 84 pp 102-107

[Article by Stig Nordfeldt]

[Excerpts] Next year Sweden will really step into the space age: our first very own satellite will go into orbit. It is the Viking--shown in the above picture [not included] in orbit above the poles, carrying out research on the earth's magnetic field. It is built by Saab-Scania, guided by our space center in Kiruna, has a maximum speed of 15,000 km and will try to solve some of the mysteries of the northern lights.

The Viking studies the northern lights from above; the picture on the left [not included] shows how they look from the Kiruna horizon.

Sweden is involved in space in several ways; among other things we have a share in the Giotto satellite that will meet Halley's comet in 1986.

Sweden's Space Goal in 1985

Sweden in space, what does that mean? We know that it does not mean walking on the moon, making a rendezvous with Jupiter or making spectacular leaps from the capsule at an altitude of a hundred miles. But other than that, most of us do not know much more than the fact that we have a small rocket base in Kiruna and that we have the Tele-X communications satellite under construction--in conjunction with Norway and Finland.

But that is just a small part of what Sweden is involved in in space. Along with 10 other countries in the European Space Agency, ESA, we have--or have had over the past 20 years--a number of research, communication, weather and remote analysis satellites in orbit. They are an important part of our everyday lives, overshadowed by the ostentatious space acrobatics of the superpowers, to be sure, but of great importance even so and definitely more peaceful.

As early as next year the Swedish space program will make its big breakthrough. Sweden's first satellite will go into space. Viking is its name--a discus-shaped craft with a diameter of 2 meters and a height of half a

meter, weighing half a ton at takeoff and 281 kg in space, a research satellite carrying almost a dozen scientific instruments placed in orbit over the poles.

In the same year, 1985, we will participate in another and perhaps even more publicized space project--the encounter of the ESA satellite, Giotto, with Halley's comet. While Viking's primary interest is in the earth's magnetic field, the ionosphere and the processes that result in the fantastic show of northern lights around the North Cape, the Giotto will steer for the head of Halley's comet in an effort to discover some of its secrets.

In 1986 it will be the turn of Tele-X with its TV revolution and sophisticated computer and video programs while in the same year the geophysicists in Kiruna will join Russian plasma researchers in the Soviet satellite, Prognoz.

The rest of the 1980's will resemble the middle part of the decade, so do not say that Sweden is not taking part in the space effort!

Our Swedish NASA, the National Delegation for Space Activity, is found in the enormous red brick building of the National Tax Division on Ballstaviken beach in Solna-Sundbyberg. Coots and ducks swim among moored yachts and barges, the water glistens in the sun and on the other side of the beach there is an enormous industrial landscape. It does not look like a space center, but that is exactly what it is: the Space Delegation authority five floors up with the executive organ, the Space Company, on the floor below.

The Viking project is the flagship of the Swedish space effort and its scientific leader is Kerstin Fredga, professor of astrophysical space research with the delegation.

"It was fortunate that the first Swedish satellite was a research satellite," she said. "But we were far advanced with our own research, the time was ripe. We knew what we wanted to do.

"A competent purchaser inspires competence. Competence on the part of Swedish industry is an important aspect in this context. We have several firms in an international class--among them Saab-Scania, Ericsson and Volvo Airplane Engines--and it is important that they are given tasks that increase their skill in the stiff competition."

The question is what will Viking actually do for us 15,000 kilometers up in space? That is the highest point of its orbit around the earth, completed in 4.5 hours at a speed of approximately 5 km a second. The lowest point is 800 km above the earth's surface.

At 15,000 km in altitude, particles from the sun approach the poles at a speed of several hundred km a second. These particles form the so-called solar wind and consist mainly of hydrogen particles, protons. In the earth's largest magnetic field--which is actually compressed a little by the solar wind on the "sun side" and pulled out into a tail further away than the moon's orbit on the shadow side--the particles are accelerated and acquire enormous

energy. When they race into the atmosphere at an altitude of 400-100 [as published] km they collide with air molecules and pull off electrons which, when they resume their place in the molecule, produce the northern lights.

"There are a great many things here that are still unclear," said Kerstin Fredga. "That is why we have the instruments on board to measure the electrical field in the magnetosphere, the distribution of particles, their energy and so forth." Incidentally the aurora borealis is not the only effect of the entry of solar particles into the atmosphere. They also produce magnetic storms on the earth's surface. In the 1950's they caused a lot of disturbance on the signal network of Swedish Railways. When sunspots increased, signals changed from red to green and vice versa. That was due to the "storms" that affected the cable network. Now the system has been changed.

The aurora borealis will also be photographed from above at the same time as it is examined from the side and from below with the help of rocket probes from Kiruna and observations from the ground. A Canadian team has built the Viking's camera and an American team will measure the magnetic field. "We were in a position that enabled us to ask some of the best research teams in the world to join us."

Including its launching with the Ariane missile from Kourou, right off Devil's Island in French Guyana on the east coast of South America, the Viking will have cost 106 million kronor in 1979 prices. That is unusually cheap, about half what a European satellite normally costs, and this has attracted international attention.

Austerity is the key word in space efforts too. The explanation for the low cost is that we made use of existing components and we were able to fit the Viking into an empty space beneath the 2-ton French remote analysis satellite SPOT, which cost most of the money. The only problem was that the Viking had to be constructed in such a way that SPOT would not crush it.

During the 8 months when the Viking will go into its elliptical orbit with its antennae and sensors extended the teams taking part in the experiment will be at Esrange in Kiruna. It is from there that the satellite will be maneuvered electronically and that is where all the data will come in. For this reason the base has been expanded with a scientific operations center.

The launching operation will be a tense moment for all those involved. There is a preset clock on board the Viking that will take care of all commands until the satellite gets into the right orbit. Three hours after separating from SPOT at an altitude of 800 km, the clock will ignite Viking's own rocket motor which will burn for 17 seconds, during which time Viking will be raised to its highest altitude, 15,000 km. After that the earth and Esrange will take over when it comes to issuing orders.

It is almost certain that Viking will live beyond the projected 8 months. It can function considerably longer unless the energy-collecting solar panels and the guidance orientation gas give out. Eight months is a design concept. If the satellite is to function longer it would require more things and with each

kilogram of added weight the satellite would lose a hundred kilometers in altitude. Viking will probably remain in its orbit for around 100 years after which it will descend into the atmosphere, ignite and disappear.

Like other big comets Halley's comet has been surrounded since antiquity with terrifying ideas. The Bayeux tapestries, woven a decade after William the Conqueror's victory at Hastings in 1066, show people pointing in amazement at the strange star that appeared in that fateful year. It can also be seen as a peculiar star of Bethlehem in Giotto's painting of the adoration of the Magi, painted in 1304, 3 years after another visit from Halley's comet.

This comet has been observed--and reported--by people since the milennium before the birth of Christ. It returns every 76 years, a fact that was first discovered by the 18th century astronomer Edmund Halley, and in 1986 it will be back again. For the first time people will be out in space in an effort to find out what a comet really is. A space probe will be sent up from ESA's Giotto, but there will also be probes from the Soviet Union and Japan.

What we know or think we know about comets is based on observations from earth, including spectral analyses of the coma, the sheath and the tail.

"The space probe will go as close to the head of Halley's comet as possible without becoming damaged," said Professor Fredga. That means around a thousand km. Ten instruments on board will measure the occurrence of various elements, gases and materials.

If Giotto survives it can go on to study another comet, Temple 2, which will appear in 1988.

If all goes well Swedish space research could contribute to increased knowledge of both the northern lights and comets, two magnificent heavenly decorations. We will also have a small involvement when the Americans send up Space Lab. A group at KTH [Royal Institute of Technology] has already sent up tests, curious as to how the process of coagulation occurs under conditions of weightlessness. Who knows, perhaps within the near future we will produce metal alloys in space foundries, alloys that would be impossible on earth.

One of the current space projects is known as remote analysis or remote sensing. From a high altitude observations are made of the weather, the extent of the ice cover and its thickness, changes in vegetation, future harvests and much more. Soon it may be possible, with the help of satellites, to see not only the size of oil spills but also where they came from, which would pinpoint responsibility.

Space efforts are no longer a luxury, they are a necessity--and if we hang on, advanced Swedish industry will have a lot to do both in space and on the ground.

PHOTO CAPTION

1. p. 104. Kerstin Fredga, professor of astrophysical space research, is the scientific leader of the Viking project. The project's operations center is located at Esrange in Kiruna.

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CSO: 3698/75

BRIEFS

ITALY PARTICIPATES IN ARIANE 5---Rome--It was learned on 26 September at the headquarters of SNIA-BPD, which is already building auxilliary engines for Ariane-3 at Colleferro, near Rome, that Italy intends to participate in the construction of the new European launcher of the 1990's, Ariane-5, for which it plans to build two auxilliary rockets. The company has just completed a study commissioned by the European Space Agency, on two auxilliary solid fuel rockets with a length of 20 m and a diameter of 3 m, which should assist the main rocket, propelled by liquid fuel, in reaching earth orbit. Each of the two engines should cost 9.5 billion lire (47.5 million francs). The construction will require eight years of work. The same source also indicated that Ariane-5 must transport a 14-ton load to an altitude of 200 km, which is one-half the load carried by the American Space Shuttle. At the beginning of October, France must present its project for Ariane-5, prepared by the National Center for Space Studies (CNES). [Text] [Paris AFP SCIENCES in French 27 Sep 84 p 13] 11,023

CSO: 3698/29

USE OF CERAMICS IN INTERNAL COMBUSTION ENGINES

Paris LE MONDE in French special supplement 5 Oct 84 pp 44-45

[Article by Jean-Francois Augereau: "Put Ceramics In Your Engine"]

[Text] In these times of high energy prices, anything is worth trying to improve car efficiency: redesigning car bodies to reduce the air resistance and the C_L [lift coefficient] which has now become a selling point for admen; lightening the body shells and all mechanical car parts; improving engine performance and often reducing engine weight for the same displacement; turbocharging; enhancing tire performance; using modern transmissions, etc. There is no lack of examples showing the car manufacturers' efforts to improve their vehicle efficiency. A mere comparison with the products available to consumers some 20 years ago will convince anyone. Progress has been made, therefore, but it bears on relatively traditional research fields.

This, however, does not apply to the manufacturers' research on ceramics. Not the earthenware and the potteries which that word will immediately bring to mind, but rather highly technical materials which, like zirconia, aluminum titanate, SiAlon, alumina or silicon carbide and nitride, offer remarkable high-temperature mechanical properties. According to the manager of the engine department of the Peugeot technical division, "ceramics and their composites are to engine mechanics what plastics became in the 1960's for automobile equipment and accessories." A revolution? Not yet. No one has yet grounds for complacency, even though all place great hopes in these materials and even though ceramics--albeit in small amounts--have been used in engines for a long time as spark-plug insulators.

Aside from this trivial detail, engine manufacturers, rightfully eager to improve the reliability and efficiency of their engines and reduce their fuel consumption, are trying all means to reduce engine heat losses, the effect of which can easily be observed by lifting the hood after a few kilometers. Actually, a large proportion of the energy produced is dissipated in the exhaust pipes (about one third) and in the cooling system (another third). Recovering these lost calories and putting them to more noble uses, therefore, amounts to improving the power plant operation.

In principle, considering their intrinsic qualities, ceramics should be able to achieve just that. Indeed, they can withstand high temperatures, they

have a good corrosion and wear resistance, a low density making it possible to make lighter parts and, above all, they are poor heat conductors, a quality much in demand to insulate hot engine parts. Briefly, they are a priori ideal materials and we might think that the all-ceramic engine is just around the corner.

Alas! It is too good to be true, as ceramics and car manufacturers, even in Japan, found out. The rose has a thorn, and it is a big one: ceramics are actually hard to machine and brittle due to their lack of plasticity. Then what? Should we renounce all the advantages they could offer? Certainly not. But it will take patience, as Mr Hubert Koslowski, of the Renault scientific and technical department, and Mr Bernard Malassine, of the European Propulsion Company, pointed out at recent conferences.

Actually, we cannot hope for ceramic parts to replace all the moving or fixed mechanical parts of an engine. According to experts, "in 10 years from now, we should have about 5 kg of ceramics on an engine. Five kg of parts made of different ceramics, as there is no universal material that could meet all the requirements." A rapid review of potential applications will convince us of that.

This is the case for the exhaust-pipe insulation at the outlets of the cylinder head and combustion chamber. If some technicians consider that, in the first case, the problem is about to be solved through the use of aluminum titanate (Peugeot is said to research a different process), on the other hand they are less positive in the second case. Silicon nitride, whose porosity is said to have been eliminated at last thanks to new production processes, would be a good candidate as a material for these combustion chambers, which are now made of expensive alloys.

For piston crowns, which are subjected to high thermal and mechanical stresses, and for the upper sleeves as well, engineers are considering zirconia. But they still have to solve the difficult problem of securing it to the piston crowns, which are made of cast iron in industrial engines (which makes things easier) and of aluminum in light-vehicle engines. That would also leave a major difficulty: the cylinder-head plate is posing special problems due to all the openings it contains. As a result, manufacturers may have recourse to very special ceramic-ceramic composites for that plate.

Considering the problems involved in using all these materials, as well as all the advantages they offer, it is clear that their penetration will be relatively slow. "Their application on large-series small-displacement engines before the 1990's appears excluded." On the other hand, according to experts, "it is reasonable to think that the two major application fields of these materials will be primarily large industrial diesels and light-vehicle diesels, bearing in mind that the solutions adopted in one case will not be suitable for the other." According to Mr Gaston Sifre of the Peugeot scientific department, "the first engines on which ceramics will be used should be truck diesels," first because of their operating conditions, but also because these engines will require smaller part series than those required by the light-vehicle industry, and production will therefore be easier.

Experiments in this direction have been made in most industrialized countries; the largest effort in this field appears to have been made by the Japanese who, according to some, "would have a three-year lead on all others, especially for the industrial manufacturing of ceramic parts and their machining." At any rate, no one is denying that a lot remains to be done to succeed. Certainly not Renault and Peugeot which, although they cooperate in basic research, are each playing their own hand when it comes to applications that could one day lead to sales. But the game is probably worth the candle.

A Race by Heats

Mechanical engine parts cannot be replaced overnight by ceramic components. Before we can do that, we must learn how to prepare raw materials suited to the problem--this is what chemists are doing--we must be able to machine these materials and give them their final shapes, and that is the ceramists' task. Finally, and this is where car manufacturers come in, we must try to integrate these new parts into engines--sometimes by completely redesigning them.

In this race, the Japanese "have got a lead" according to French raw material producers. "By 1986, French chemists and ceramists will have caught up with their Japanese competitors," French manufacturers will add. These statements, however, appear rather optimistic. Certainly, French authorities launched a ceramics research program two years ago. But can we compare their efforts to those of the Japanese?

In 1981, the Japanese government, through its "super-ministry" of industry, the MITI [Ministry of International Trade and Industry] initiated a research and development program for the basic technologies of tomorrow's products; for the fine ceramics sector alone, the project received subsidies of $1.65 million over 10 years. The following year, the Ministry of Education, Science and Culture allocated an additional $1 million for research in that field.

The United States, which at first seemed less confident as to the prospects opened by the introduction of ceramics in thermal engines, now seem to embark on the venture and deploy large efforts to expand the basic research needed to develop these materials. "When they really start, they will soon become efficient," people at Rhone-Poulenc predicted.

Faced with such strong competitors, the Europeans are few and far between. As a result, car manufacturers such as Renault and Peugeot, which appear to be closely interested in these new materials, must sometimes order from Japanese and U.S. companies.

As far as the preparation of these ceramic powders is concerned, the situation could improve if companies such as Pechiney and Rhone-Poulenc entered the market, as they already have some experience of fine ceramics and seem ready to expand this part of their operations. But France's huge weak point remains powder processing. "We suffer from a lack of tradition in industrial ceramics," an expert observed, noting that only three larger companies are represented in this sector: Ceraver, Desmarquest (a Pechiney subsidiary),

and LCC-Thomson. A drop in the bucket since, according to a 1983 survey of the Japanese Long-Term Credit Bank, about 120 Japanese companies are engaged in fine ceramics processing!

9294
CSO: 3698/56

BRIEFS

LIGHT-ALLOY VOLVO PARTS--Volvo is now taking the first step toward manufacturing parts made of light-alloy. A facility for tests and experiments with light-alloy casting will be built at the Volvo Component Factory in Skovde at the beginning of next year. The facility will be built in connection with the existing grey iron foundry in Skovde and will provide 25 people with jobs for three years. If the tests show positive results, a light-alloy foundry will be established in Skovde. Mainly flywheel housings and inlet manifold pipes will be produced. These are parts for Volvo engines which Volvo Components currently purchases from other producers, many of which are located abroad. [Text] [Stockholm SVENSKA DAGBLADET in Swedish 8 Oct 84 p I] 12562

FRG TESTS HYDROGEN VEHICLES--The first road tests of the behavior of hydrogen vehicles started on 8 October in West Berlin, in the FRG, and will continue until the end of 1985, it was announced by the Ministry of Research and Technology in Bonn. Five vehicles using hydrogen and five others using a blend of gasoline and hydrogen are taking part in this program, the goal of which is to reduce atmospheric pollution by exhaust gases, which is considered to be the cause of the death of forests in the FRG. These cars, which were manufactured by the West German firm Daimler-Benz (Mercedes) and designed with the cooperation of the oil industry and several universities, will be used for more than one year by West Berlin administration departments. According to the Ministry of Research, several problems remain to be solved, in particular storage and production cost of the new fuel and the competitiveness of hydrogen vehicles. At present, hydrogen is five times more expensive than traditional fuels. Since 1974, the ministry has financed 50 percent of the research on hydrogen vehicles. By 1985, it will have spent a total of DM 26 million (close to $7 million) on this project. [Text] [Paris AFP SCIENCES in French 11 Oct 84 pp 82-83] 9294

CSO: 3698/64

AIRBUS DEAL VIEWED WITH SOME MISGIVING IN FRG

Hamburg DEUTSCHE VERKEHRSZEITUNG in German 12 Sep 84 p 9

[Text] Sometime this year, the American airline PanAm and the European Airbus Industry plan to wrap up the final contract on the billion-dollar deal announced on 13 September. After PanAm's declaration of intent to purchase or lease 91 Airbus units was made public, Airbus business manager Berhard Lathiere announced in Paris that 2 to 4 planes are to be delivered as early as this year.

Beginning January 1985, two planes a month are to be delivered to PanAm "until the contract is fulfilled." The contract calls first only for the purchase of twelve A-310-300's and sixteen new A-430 models for a total of 1 billion dollars. But PanAm also wants to lease twelve A-300-B4's and four A-310-200's. Lathiere left open the matter of how this leasing procedure will be executed. It is possible that the sale could be made to a leasing firm which would in turn place the planes with PanAm. PanAm also announced an option for thirteen A-310-300's and thirty-four A-320's.

If the contract between PanAm and Airbus indeed materializes and if the options are exercised--and the Airbus management is confident of this--the European partnership will have landed its biggest contract yet and have managed the second breakthrough into the American market, in spite of the vigorous competition from Boeing and McDonnell Douglas. The Airbus management proudly assured that the technology of the European aircraft per se had been the decisive factor in the PanAm decision.

Despite the atmosphere of celebration prevailing in Europe over the big contract, a certain caution is in order in assessing the billion-dollar deal. This is because the contract contains far-reaching concessions by Airbus Industry to a U.S. airline that is still operating in the red. PanAm also has the option of pulling out of the deal altogether. Even if--as announced by PanAm director C. Edward Acker--the now concluded tentative contract becomes a solid agreement by the end of the year, the carrier still has time for a contract cancellation later.

This is because the company will ask for extensive contract concessions--deemed by them to be urgently necessary for continued reorganization--from five of its

employees' unions when work agreements run out at the end of the year. Should the stewardesses, pilots and other workers of the venerable airline balk at this, PanAm has the right to bail out of the Airbus deal.

If there are contract concessions and if the deal is closed, the contract still contains a major and risky unknown factor. The European airplane maker has declared itself willing to grant credit guarantees in the event that PanAm is unable to obtain financing for the purchase of the 28 aircraft. Airbus Industry has also granted PanAm the right to choose--virtually up to the last minute--between a purchase or a lease of the 28 planes. It could very well happen that Airbus Industry will suddenly become the major leasor of its own planes if no third parties come forward to buy the Airbus planes and lease them to PanAm.

At a press conference, Acker reacted with visible consternation when asked how an airline in danger of bankruptcy intends to raise the huge sums for the purchase or lease. He claimed that the business situation has improved considerably and that the company has available liquid assets of 450 million dollars. But in the last 2 and one-half years, PanAm has suffered losses of around 621 million dollars--120 million in the first 6 months of this year. The U.S. company expects the new economical planes to improve its profits and, by taking the bull by the horns, wants to prepare itself for the ever fierce competition in aviation existing both internationally and at home.

Acker and the Airbus representatives remained silent on the conditions for the leasing agreement for the 16 new Airbus units which are to be delivered by 1985 and which will be traded in for newer models beginning 1987. However, U.S. aviation experts believe that, here too, Airbus has made "extensive and costly concessions in order at last to enter the lists against the large American competitor Boeing in its own market."

Whether Airbus Industry can succeed in breaking into the U.S. market after the meager sales so far with Eastern Airlines 7 years ago (34 planes) and recently with two smaller airlines (5 Airbusses) depends entirely on the final outcome of the PanAm deal and on whether other U.S. airlines as well are willing to be disloyal to Boeing as their principal supplier of airplanes. This will probably happen only if Airbus Industry grants extensive concessions to them too and if the new Airbus planes prove themselves in fact to be exceptionally economical.

9992
CSO: 3698/50

CIVIL AVIATION

FRG TESTS NEW INTEGRATED DIGITAL FLIGHT CONTROL SYSTEM

Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT in German
26 Sep 84 p 5

/Text/ At the end of September, at the Lemwerder Plant of Messerschmitt-Boelkow-Blohm (MBB) GmbH in Bremen, the hall gates will open for a novel research and experimental aircraft called "Attas" (Advanced Technologies Testing Aircraft System). After a good 2 years of development and reconversion work, a flight testing carrier was produced from the series VFW 614, by means of which the German Research and Testing Institute for Air and Space Travel (DFVLR) will significantly improve the instrumentarium of its air research. The VFW 614 was scarcely changed at all externally, but numerous new installations and conversions were undertaken. The cabin was originall designed for 44 passengers. It now contains work stations for four test engineers, who control control various tests, make observations, evaluate the test, and who monitor the system functions.

Copious equipment for measuring systems, instrumentation, and data recording take up space in the cabin, including especially also five interlined high-grade computers and their peripherals. Other conversions that have in the meantime been concluded concerned the installation and cabling of numerous sensors, the installation of additional control surfaces at the wing, and multi-channel (redundant) electrohydraulic positioning drives for the primary and secondary control and for the propulsion systems, as well as the required expansion of the systems for power production, distribution, and matching. By means of this complex equipment, the aircraft can be controlled in test operation by means of electric command transmission, manually, and fully automatically ("fly by wire"). At the same time, the research and testing aircraft "Attas" could be stamped with the flight characteristics of other aircraft which, for example, might still be in the planning stage. Thus, such aircraft could be investigated practically at an early stage of their development (inflight simulation).

During the next months, "Attas" will be tested by MBB on the ground, before the research aircraft will make its maiden voyage in 1985. The ground tests and subsequently the air tests by MBB will be used to demonstrate the required performances and standards which are needed to release the aircraft by the Federal Aviation Agency. After these tests have been successfully concluded,

"Attas" will be delivered to the DFVLR in Braunschweig by the middle of the next year; it will there be equipped with the extensive data processing system that has been programmed by the DFVLR.

In 1986 the aircraft will begin to be used by the individual institute of the DFVLR and by industry. Its application essentially extends to the testing and demonstration of new concepts within the framework of the integrated, digital flight-guidance systems including navigation and air traffic control; the investigation of flight and system properties by inflight simulations; and finally the investigation of aerodynamic future technologies, especially in connection with the boundary layer on the wing and on rapidly moving flaps.

8348
CSO:3698/20

REVIEW OF FOKKER'S POSITION IN AIRCRAFT INDUSTRY

Brussels LA LIBRE BELGIQUE in French 29-30 Sep 84 p 16

[Article by Pierre Sparaco]

[Text] Civil aeronautical construction has been gradually transformed into a battle of the giants and a dance of billions of dollars. However, in addition to Airbus Industrie, Boeing and McDonnell Douglas, which only produce airliners with a minimum of 120 to 150 seats, other pretenders may be setting their sights on part of the world market which is far from being negligeable, beginning with the so-called regional airplanes.

It is in this context that Fokker should be placed, which is much more than a mere "outsider." A company which employs 8,400 persons and which has compelled our admiration for several decades. In fact, the Dutch, while at times agreeing to join international cooperation programs, feel that come hell or high water they will always be able alone to produce aircraft of their own design and thus to maintain real independence.

The government authorities support and encourage this ambitious policy, notably because they have a good memory. In the 1950s, they supplied Fokker with reimbursable aid to assist in the development of the twin-engine F27, "Friendship," in exchange for royalties paid pro rata out of sales and without time limitation. A gilt-edged investment. In fact, the career of the F27, guided by the hands of a master, is not yet over; and the authorities at the Hague continue to garner sizable royalties in this manner.

The current balance sheet shows that 755 units have been sold. They are being used by some 164 air companies, air forces, private enterprises, government officials, etc., in 63 different countries. However, the recession hit the F27 hard, all the more so since many second-hand airplanes were available throughout the world. This year, for example, the production rate has fallen to only one airplane per month.

In Uniform

To compensate for the weakness of the marketplace, Fokker decided to produce new, military versions of the F27. This is not the first time that "Friendship" has put on a uniform; however, this time it is going much further. At

the recent air show in Farnborough, we saw airplanes named "Enforcer" and "Sentinel," destined for armed maritime surveillance and advance air detection.

"The "Enforcer" carries very complete electronic equipment and can even be armed with a redoubtable panoply of torpedoes and missiles, including the "Exocet." As for the "Sentinel," thanks to a high-performance American radar, it is in a way an AWACS [airborne warning and control system] capable of seeing everything at a range of 150 kilometers.

In the electronic warfare sector, the pretensions of the F27 will go even further since the "King Bird" which is being developed will do better.

In the meantime, the twin-engine jet F28 is also following its course, but in a relatively less brilliant fashion. The order book cites 216 orders, but in this sector the production rate is still 12 per year.

This depressed current situation, far from discouraging Fokker, was taken advantage of in preparing the next model. First of all, the F50, which will be flying in October 1985, is a technologically rejuvenated F27, an airplane which will offer 50 seats and very low operating costs. It is aimed at the regional companies, in the face of competition which bids fair to be very severe, account taken notably of the British Aerospace ATP or the Aerospatiale-Aeritalia ATR 42, two airplanes offering similar characteristics. On the other hand, the experience acquired thanks to the F27 constitutes a significant asset.

A "100-seat Plane"

To complement rather than replace the F28, Fokker has also begun work on the twin-engine jet F100 which will start its test flights in mid 1986. Although no firm orders have yet been announced for the F50, the F100 is benefiting from the prestige bestowed upon it by its first buyer, Swissair.

The choice made by the big Swiss company drew much comment, the more so because it confirms that there is more than one market for an airplane smaller than the Boeing 737, McDonnell Douglas MD-80 or Airbus A320.

On the other hand, the depressed current situation is being visibly prolonged beyond what had been forecast in Amsterdam, which means that the two new models are taking shape without the benefit of start-up orders of some importance. However, Fokker is awaiting the resumption of activities without real impatience, convinced that its technical and commercial choices were well-founded.

The F50s and F100s represent an overall industrial investment of about 1 billion florins, 90 percent of which is in the form of recoverable advances from the state.

Although the Dutch company is now producing two airliners per month, which is a modest rate, on the other hand it is benefiting from a complementary work program marked by great stability, to begin with the manufacture of subassemblies and the final assembly of General Dynamics F-16 fighter planes.

Two F-16s leave the big hall at Schiphol every month. What is more, the plant in Woensdrecht will soon be able to count on important contracts relating to the "Patriot" missile. Furthermore, as an associate member (just like Belgium), Fokker is linked with Airbus Industrie for the A300s and A310s while it also participates in the production of Shorts 360, which recently received an impressive number of orders, including a military model destined for the Pentagon.

With annual sales of a little over 1.5 billion florins, almost all for export, Fokker, therefore, continues to be an important and at the same time ambitious company. And that even though the national Dutch market in the aeronautics sector remains tight, to say the least.

8143
CSO: 3698/35

AUSTRIA WANTS TO JOIN 'ESPIRIT' PROGRAM

Vienna DIE PRESSE in German 4 Sep 84 p 9

[Article by Herta Scharsach: "Austria Wants to Go Along With the EEC on 'Espirit' for the Sake of High Technology"]

[Text] Vienna--With "ESPIRIT," the Europeans want to jump aboard the speeding technology express. Within a period of 5 years the EEC governments will invest the equivalent of about 12 billion schillings, and industry as much again, in research and development of methods, technologies, and processes for hardware, software, and systems of advanced information technology. With that, the Europeans are starting at the last minute, so to speak, to put on a strong-man act in order to decisively reduce the technology lead of the Japanese and Americans. Austria as well wants to go along with the technology assistance program of the EEC.

At the conference of the council of EEC research ministers in February, the resolution was adopted on the execution of the 10-year "European Strategic Program for Research and Development in the Field of Information Technology" (ESPIRIT), and at the same time the detailed program for the current year was approved. Universities, businesses, and a great variety of organizations are involved in the efforts to achieve a new basis of technology.

Among 400 projects 90 schemes were initially chosen, which are being supported with about 3 billion schillings. Assistance funds are being provided for a better circuit technology in microelectronics, new, more direct communication methods between man and machine, the development of a new software generation, the exploration of aspects of intelligent interactions between man and machine, as well as further developments in computer-controlled production. In this connection the objective of the ESPIRIT strategy is to create an information system accessible to all interested parties in order to ensure the most sweeping possible dissemination of research results.

Austria is particularly interested in such an access. The problem in this connection is that the EEC Commission makes the awarding of contracts for projects dependent on the contracting party having its headquarters in the Community. EEC Vice Chairman Etienne Davignon recommended to Austrian applicants that they establish contacts with businesses in the Community.

Companies from the EFTA [European Free Trade Association] area above all have a chance only if they have "counter-considerations" to offer for taking part in a project and if the government assumes half of the costs. But in Austria a completely new assistance institution would have to be created for that purpose.

Presumably at the end of the year the EEC will invite applications for projects for the 1985 program. In order to probe the interest of Austrian firms, the science ministry recently invited companies, ministries, and interest groups to a meeting, and another gathering will be held in November. Until then, project descriptions and realization proposals are supposed to be drawn up, the cost limits are to be marked out, and possible partners are to be sought in the EEC. The extent of these projects could add up to several hundred million schillings.

"We do not yet know precisely under what conditions we can take part," stresses graduate engineer Dr Paul Salajka of the research section of the science ministry. For the experts, there is no question that there should be participation in the ESPIRIT program: "Otherwise the Americans and the Japanese will outstrip us by so much that we will not be able to catch up."

12114
CSO: 3698/1

FACTORY AUTOMATION

NORWAY MAKES FIRST MASS-PRODUCED UNDERWATER ROBOT

Stockholm NY TEKNIK in Swedish 30 Aug 84 p 6

[Article by Christer Kallstrom]

[Text] A new type of advanced underwater robot has been designed in Norway. The robot, which is very small, can operate down to a depth of 600 meters. It can make inspections and carry out simple mechanical tasks.

Sprint 101, as the robot is called, will be the first mass-produced robot. It was developed by the Bergen firm, Bennex, Inc., and Norwegian Shell. The robot will cost half a million Norwegian kroner and will be ready for delivery by the beginning of next year.

The robot is very small: 61 cm long and 61 cm wide. It is 47 cm high. It weighs no more than 41 kg out of the water and runs at a speed of around 3 to 4 knots.

Sprint 101 is designed to operate down to 600 meters below the surface. The limit for a deep-sea diver today is around 400 meters. But when divers go down that far their ability to work is extremely limited.

The idea is to have the robot perform inspections and maintenance work. It is also intended to carry out simple mechanical tasks such as cutting pipes and wires and bringing up samples from the ocean floor.

The robot can transmit a high-resolution TV picture from the bottom to the operator aboard a surface vessel. The picture is produced by a combined color and black-and-white TV camera and a 35 mm film camera.

Development costs for the robot amounted to 9 million kroner. The project was supported by the Norwegian Industrial Fund.

Sprint 101 will be manufactured entirely in Norway. It is estimated that several hundred robots can be delivered over the next 10-year period to buyers around the world.

6578
CSO: 3698/66

JAPAN, FRANCE SIGN MACHINE-TOOL ACCORD

Paris ELECTRONIQUE ACTUALITES in French 12 Oct 84 p 1

[Article: "French-Japanese Cooperation on Machine-Tools"]

> [Text] A commercial and technological cooperation agreement was just signed between the French machine-tool manufacturer Intelautomatisme and the Japanese manufacturer Hamai. The first application of this agreement, which was signed for 6 years, will involve third-generation vertical machining centers.

Under the agreement, the complete line of Japanese vertical machining centers will be available to the French manufacturer already next January. They will be manufactured under license and distributed under the Huron brand in Europe, Africa and on the South-American continent.

Hamai is one of the three leading Japanese manufacturers of vertical machining centers and milling machines, and the leader for precision gear-cutting machines and electric-discharge machining equipment.

Renowned for its technical expertise, this manufacturer achieved sales equivalent to FF 370 million in 1983, and will complement the Intelautomatisme line of medium and low-end machines.

Th result of a merger between Hure and Graffenstaden, Intelautomatisme for its part achieved sales of FF 400 million in 1983. This manufacturer is now replacing traditional machines with a catalog of high-end numerically-controlled products: vertical and horizontal lathes and milling machines. Its alliance with Hamai leave other prospects open and does not exclude the entry of Ernault Somua in the Intelautomatisme group, should the authorities make a decision to that effect.

The next stages of the Intelautomatisme-Hamai agreement provide for a concerted approach of the U.S. market, and Hamai's access to the Hure line of milling machines.

More generally, the two partners will exchange knowhow in all fields of computer-integrated manufacturing: machining systems, computer-assisted design and manufacturing, etc.

9294
CSO: 3698/64

BRIEFS

SHIP-WELDING ROBOT--Wartsila, Rosenlew and Kemppi are going to cooperate in developing a welding robot to weld large sections of ships. The robot will be the first of its kind in the world. The contract which will be signed today between the firms is a beginning in Wartsila's attempt to automate the shipbuilding industry. According to the plans the new robot will begin operating in January, 1986. The robots will be placed in both factories which Wartsila is now building on Artholmen in Helsinki. According to what HUFVUDSTADSBLADET has been able to ascertain, Wartsila has been pondering for the past two to three years over how the welding of the large ship sections could be done more quickly and reliably. Cooperation with foreign firms was discussed before the decision was made in favor of Rosenlew and Kemppi. Within the cooperation, Wartsila will provide the know-how in terms of shipbuilding, Rosenlew will have the responsibility for robot technology and Kemppi will provide the welding. The robots will weld all the seams in every section. Today the seams are welded by hand. [Text] [Helsinki HUFVUDSTADSBLADET in Swedish 24 Sep 84 p 11] 12562

NEW FRENCH ROBOTICS PROJECT--Maurice Allegre, director of DESTI in the Ministry of Research and Technology, announced it at the Third Workshop on Robotics Research, in Toulouse. This project, which will bring together public and industrial laboratories on the topic "The Flexible Robot of the Future," will become one of the new actions in the computer-integrated manufacturing program. Its official presentation by Hubert Curien, minister of research and development, is expected in three months. [Text] [Paris L'USINE NOUVELLE in French 4 Oct 84 p 39] 11,023

FRENCH DEVELOP ROBOT MICROCAMERA--A microcamera which could have important applications in robotics, was perfected by researchers at LSI (Laboratory for Computer Systems Language) in Toulouse. The size of a matchbox and weighing 28 grams, this camera can capture 25 images per second or operate shot-by-shot from stills to 200 frames per second. Its fabrication is presently being negotiated with a Toulouse company whose name was not disclosed. Its price would be between 3000 and 10,000 francs. The small size of this component would make it possible to locate it in the palm of a robot's hand. Among other things, the camera could also be used for computer vision, for industrial control, for CAD (computer-aided design), for surveillance, or for automatic sorting. [Text] [Paris ELECTRONIQUE ACTUALITES in French 7 Sep 84 p 4] 11,023

CSO: 3698/29

SWEDEN FOUNDS NEW LAB FOR SEMICONDUCTOR RESEARCH

Stockholm TEKNIK I TIDEN in Swedish No 3, 1984 p 11

[Text] A new laboratory for advanced research on new semiconductor materials has been opened in Lund. The laboratory is named for chemist Jons Jacob Berzelius--who was one of those to discover such elements as selenium and silicon, among other things--and will be used for basic research of great importance for industrial renewal in this country.

The solid state physics division under the leadership of Professor Hermann Grimmeiss will work here.

The name of the division indicates that this does not involve chemistry but the mechanical, thermal, electrical, optical and magnetic properties of solids and liquids. Corresponding basic education ranges from metals to insulators, from crystalline to amorphous materials, from basic physical phenomena to modern industrial products.

Semiconductors

"This is an incredibly wide-ranging area and therefore our research here will be limited from the very beginning to one of these items, namely semiconductor physics. Here we will investigate materials that conduct electricity better than insulators but not as well as metals," Professor Grimmeiss explained.

Of course the semiconductor material that has been most discussed in recent years is silicon, which is used in electronics.

Gallium Arsenide

But the industry already needs new semiconductor materials for special applications, such as gallium arsenide for use in optical communications and fiber optics.

"The Berzelius laboratory gives us the opportunity to develop our semiconductor research under favorable conditions. Here there are so-called 'clean rooms' where the air is 10,000-100,000 times cleaner than 'fresh air' and

contains no more than a hundred dust particles per cubic meter. The manufacture of semiconductor components must occur under very clean conditions. In addition we will be able to handle very dangerous gases with adequate safety," said Hermann Grimmeiss.

More Engineers

At the dedication ceremony in May, Industrial Affairs Minister Thage G. Peterson said:

"We must start working seriously on technical deficiencies in industry and make further efforts in the area of computers and electronics to increase the education of civil engineers and high school engineering students. The government is working on these questions. The Industrial Affairs Ministry has made an inventory of educational needs and I myself have been in touch with several business leaders in connection with this. We will not allow deficiencies in technology to jeopardize industrial development in our country."

The industrial affairs minister also stressed that Sweden must rally its forces around areas where we have or can achieve a position of strength--areas like information technology and microelectronics.

More Contact

The 5 year microelectronics program at a cost of 700 million kronor is a step in this direction.

Broader lines of contact between research and businesses are another urgent matter.

This issue of TEKNIK I TIDEN reports on some attempts to stimulate these lines of contact, such as Ideon in Lund, the Technology Park in Goteborg and the Mjardevi research village in Linkoping.

6578
CSO: 3698/66

MICROELECTRONICS

FRG, NETHERLANDS USE X-RAY LITHOGRAPHY TO MAKE SEMICONDUCTORS

Duesseldorf VDI NACHRICHTEN in German 24 Aug 84 p 4

/Excerpts/ In microelectronics, the trend towards smaller and smaller chips is continuing. The Federal Government is also participating in the race for this promising market. Beginning in the middle of next year, the "Institute for Microstructure Engineering" of the Fraunhofer Society in Berlin will begin its work. The main research interest will be X-ray lithography, a new method for producing chips with still greater storage capacity.

Here, the further miniaturization of semiconductor structures is gaining in significance. This point was emphasized by the Fraunhofer Society for funding applied research.

For further developments, the Society, in collaboration with Siemens Company, Philips, Telefunken, and Eurosil, is using synchrotron radiation from the BXrlin Electron Storage Ring Bessy. Synchrotron radiation arises when electrons at nearly the speed of light are forced into a curved orbit by means of magnets. They then emit energy in the form of radiation, whose spectrum extends from the infrared through the visible as far as soft X-ray radiation. Bessy was dedicated to its task at the beginning of 1982. Its light is equally important for basic research and for applied research in numerous disciplines: It aids in the solution of chemical, physical, biological, and medical questions.

22 Million DM for Research

A short time ago, the topping-out ceremony was celebrated with Bessy for the "Institute for Microstructure Engineering" of the Fraunhofer Society. Beginning in the middle of next year, it is supposed to be fully operational. The 22 million DM institute is being financed by means from the Federal Ministry for Research and Technology as well as by the Land Berlin. Already in 1977, the Fraunhofer Institute formed a working team in Munich for solid state engineering, to develop X-ray lithography. The three above-mentioned companies also participated therein. When Bessy was being planned, one-fourth of the laboratory area was reserved in advance for researching the new semiconductor technology.

What is X-ray lithography all about? Today, visible and ultraviolet light is used to produce computer chips. In this way, the semiconductor structures, which are shown magnified on a mask, are projected on the silicon wafer. Lens systems here manage the microscopic reduction of the structures. A light-sensitive lacquer is first applied to the chip. Wherever the rays strike, the lacquer vanishes. Then the structures, which have thus been "burned" into the lacquer, can be etched into the semiconductor material. This mode of production has its limits, however: The finer the structures, the smaller the dust particles which lead to interferences. The production process will therefore have to run fully automatically in the future. For this reason, experts expect that a chip with more than 4 million memory cells, which is still supposed to be marketed during the eighties, will be the most complicated memory module produced by conventional techniques. Its silicon structures, at any rate, will only measure 0.5 thousandths of a millimeter.

On the other hand, by means of X-ray lithography, one can achieve structures which are smaller than 0.1 thousandths of a millimeter. This could already be demonstrated by the working team which moved to Berlin after the opening of Bessy. With this technology, X-ray beams, with their much smaller wavelength, directly draw the microscopically small structures on the semiconductor.

But this also entails disadvantages: Now the masks must be just as small as the desired structures. To produce the miniscule masks, one can use electron or ion beams. However, electron-beam writing is not yet precise enough for this purpose. According to the requirements of the Berlin research team, Philips has now developed a new electron-beam writing system, by means of which mask production is supposed to be tested. Much development work is also still necessary for the source of the X-rays, which are supposed to be as parallel as possible. Other than in the case of the X-ray tube, this is indeed the case with the synchrotron, but such large installations as Bessy are much too expensive for manufacturing purposes.

Consequently, the development of compact memory rings is also a task of the working team, under the management of Professor Dr. Anton Heuberger. In 1985, such a compact ring, with a radius of only 40 centimeters, will for the first time emit radiation on an experimental basis. Another problem is the exact alignment of the masks. In the production of a component, up to 16 masks are sequentially projected onto the semiconductor material. An initial prototype of an appropriate unit will shortly be delivered to Berlin. And so the Fraunhofer Society is optimistic that, already during the first half of the nineties, a beginning can be made with the mass production of highly integrated computer chips using X-ray lithography.

8348
CSO:3698/20

ORGANIZATION OF PRODUCTS, INSTALLATION OF SGS-ATES OF ITALY

Baden NEUE TECHNIK in German Oct/Nov 84 p 28

/Text/ SGS-ATES Componenti Elettronici SpA is a semiconductor company with its headquarters in Italy. It is active all over the world. It was created in 1972 as a consequence of a merger and is today known by the abbreviation SGS. At this time the company has representation in 12 countries. Its conglomerate sales in 1983 were 230 million dollars, where the U.S. fraction amounted to 30 percent. The fraction for research and development at the present time amounts to 14 percent of annual sales. Research and Development Centers are found in Agrate (I) for MOS, in Castelletto (I) for bipolar linear devices, and in Catania (I) for power devices. In 1982, design centers were opened in Phoenix (USA) and Grafing (FRG). Other ones were opened in 1984 in Rennes (F), Singapore and Aylesbury (UK). Figure 1 provides a product survey. The two largest product capacities are found in Agrate (2400 persons) and in Catania (Figures 2 and 3) in Sicily (1700 persons). Two other production units are found in Rennes (F) with 400 persons and in Kirkop (Malta) with 500 persons. Production sites are also operating in the Far East, with 1500 persons in Singapore and with 1300 persons in Muar (Malaysia). Collaborative contracts exist with Toshiba. There licensing agreements with Zilog, and further agreements with Silicon General, Unitrode, and National Semiconductor.

BIPOLAR

Integrated Circuits	Discretes
Linear High Voltage	Power MOS
Linear power	Power epitaxial base
Linear low noise	Power epitaxial planar
Standard linear	Power multiepitaxial planar
I2L	Power multiepitaxial mesa
Digital LPS	Small signal planar

MOS

CMOS integrated circuits	NMOS integrated circuits
High density CMOS	HMOS high density
Si - gate	NMOS standard
4000 A/B standards	NV-RAM (EEPROM)
	EPROM

Figure 1: SGS Product Survey

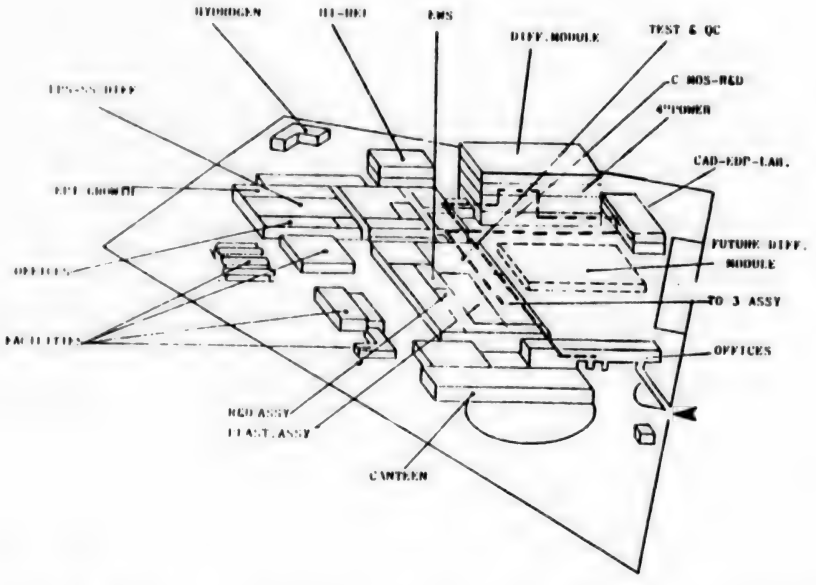

Figure 2: The SGS Plant in Catania. Just the auxiliary operations require about 10 times the area of the actual production modules.

Addresses of the SGS offices in Switzerland:
SGS-ATES AG, Oberneuhofstrasse 2, 6340 Baar
Telephone 042/31 59 55, Telex 86 4915
SGS-ATES SA, Chemin Francois-Lehmann 22
1218 Grand-Saconnex
Telephone 022/94 64 62/3, Telex 28895
SGS-Generalvertreter:
Elbatex AG, 5430 Wettingen

8348
CSO:3698/20

'SILICON BAVARIA' CONTINUES TO EXPAND IN FRG

Duesseldorf HANDELSBLATT in German 11 Oct 84 p 14

[Text] Munich, 10 October--A study commissioned by the Bavarian Ministry of Trade and Commerce assesses the chances as positive for a dynamic development of the microelectronics industry in southern Germany, especially in Bavaria. But "Silicon Bavaria" is not to become a copy of Silicon Valley or of Japan, stressed Anton Jaumann, Bavarian minister of trade and commerce.

With 230,000 workers, the electronics industry is, nevertheless, the number one employer in Bavaria. One out of every four jobs in electronics in the FRG is in Bavaria, although the precentage of its population and industrial power in each case ranks only around 7.5 percent of that of the FRG. About 110,000 jobs in Bavaria are in the communications industry along--i.e., in components, telecommunications, recreational electronics, computer science--and in supporting branches of the air and space industry. Almost 40 percent of the approximately 600 software suppliers in the FRG have their headquarters in Bavaria.

Over the last several years, around 10,000 additional jobs have been created in the field of microelectronics alone. Jaumann calculates that in the next 4 or 5 years another 20,000 jobs will be added at already existing firms and at firms that will move there. In 1985 the Bavarian minister of trade and commerce will visit firms in America and conduct negotiations on founding branch operations in Bavaria. He says that talks are already in progress with these U.S. firms.

The study conducted for the Ministry of Trade and Commerce emphasizes that, due to the proximity to one another of component development and application, there exists a sufficiently "critical mass" for continued development and application of microelectronics technology. The study points to the wide variety of existing educational and research institutions and innovative major corporations and of small and medium-sized firms as well. A continued development of the electronics industry in Bavaria requires a resident production of electronic components on the widest possible scale.

Consulting university institutes, above all, and consulting groups close to universities are particularly important for furnishing specialized knowledge in the field of microelectronics. Jaumann stated that during the 2-year study the already recognizable findings were being translated into initiatives of the Bavarian government.

This program calls for development measures in the university and extra-university sectors. In the extra-university sector, a business promotion group founded in northern Bavaria funded a so-called endowed professorship for "integrated components" with grants in the millions and is also supporting the Center for Microelectronic and Information Science founded March 1984 in Erlangen.

The Bavarian government, he said, has supplemented these private initiatives of business by creating another new professorship for "computer-aided design" (CAD) and by helping to support the Erlangen center. In Munich too, a business promotion group has been founded to support the application of new technologies. It focuses primarily on information science and microelectronics. The Fraunhofer Institute for Solid-State Technology is to be expanded with its help.

High priority must also be attached to improving training and continuing education, he said. This is true of all levels of training. Jaumann sees a great need to catch up in this area especially. The school curricula here should be expanded too. Microelectronics should play a more vital role in general education.

9992
CSO: 3698/50

NEW FIRM TO GET AEC-DEVELOPED OPTICAL FIBER TECHNOLOGY

AEC Plastic Optical Fibers

Paris CEA NOTES D'INFORMATION in French Jul-Aug 84 pp 13-15

[Article: "Plastic Optical Fibers: Research and Development at the Saclay Atomic Research Center"]

[Text] A new way of conveying data was developed in the past decade with optical fibers.

From the start, it was clear that two essential characteristics of optical waveguides would drastically change the traditional data-transmission methods using cables: their very large passband, their very low attenuation.

Visible light is an electromagnetic radiation having a frequency of the order of 5.10^{14} Hz, i.e. (roughly) 5 million times higher than that of the UHF or microwave carrier-frequencies. An optical fiber acts as a light-waveguide making it possible, for instance, to convey data over a 50-km range with a passband of 500 kilobits/second.

The performance required for long-distance telecommunication projects is among the highest; for instance, attenuations as low as 0.2 dB/km with passbands of several hundreds of megabits per second. Fibers making it possible to approach such a performance are usually drawn from a core made of silica or fluorine-containing glasses.

Low-Cost Data Transmission

In the case of plastic optical fibers which we are considering today, performance figures are far more modest (150 to 200 dB/km) and will prove competitive only in short-distance and very-low-cost industrial applications.

Actually, besides the passband and the attenuation, other properties play a part in industrial applications; for example:

- Insensitivity to outside stray radiations and the absence of mutual induction between cables.

- Resistance to hostile environments, in the nuclear or chemical industries.

- The possibility of conveying laser light to a well-defined point and, in return, to pick up the light reflected and diffused by the lit room.

This distinctive characteristic will make possible applications such as bar-code reading and automatic part-sorting in a production line.

When the light transmitted is that of a laser, fine metrology operations are possible through the use of the space and time coherence properties of light. The flexibility and light weight of optical fibers make it possible to take full advantage of the above-mentioned properties and to make optical sensors capable of fetching data from the fingertips of robots.

From the moment the first optical fibers appeared, the Saclay Atomic Research Center paid careful attention to their many potential applications in the nuclear field:

- In high-energy physics, plastic optical fibers doped with scintillating materials were applied to the detection of elementary particles (IRF [Fundamental Research Institute of the Saclay Atomic Research Center], DPhPE [Department of Elementary Particle Physics]).

- In hostile environments where intense ionizing particle fluxes prevail, [optical fibers were used] as links with sensors; as replacements for coaxial electric cables in experiments where light weight and the number of cables to be fitted in a given diameter are determining factors; as links between sensors and data-processing units, to measure ultra-rapid phenomena.

- For daily use in optics and analytical spectroscopy laboratories, to replace sets of mirrors or prisms.

During the past few years, the Saclay Atomic Research Center has acquired expertise in manufacturing plastic optical fibers, and in particular scintillating fibers designed for electro-optical detector assemblies used in elementary particle physics (IRF, DPhPE, STIPE [Instrumental Methods Department]).

In Saclay, the IRF has developed for its own use high-performance methods to draw and sheath plastic fibers made of PMMA (methyl polymethacrylate) or polystyrene.

The core of these fibers is sheathed in a thin layer of a second plastic material having a lower refractive index.

Although the performance of plastic fibers is lower (100 to 200 dB/km) than that of silica fibers designed for telecommunication uses, their low cost, their wide optical aperture and their greater ease of connection open to them a vast range of applications in which transmission length is not the most important parameter.

We can mention, for instance, the automotive industry where very simple applications exist, such as confirming that turn light-signals and other car

lights are operating properly by transferring the very light emitted by the light-bulbs involved onto the dashboard. We can imagine the weight gain on one car, and how many yards of copper wire, how many bulbs, etc., could be saved.

Still in the automotive sector, we could consider using these fibers as ignition-timing sensors, to control the thyristor that is already installed under the hood of the most recent car models.

In addition to the fiber itself, we then arrive at the concept of optronic system, which may include a modulated light-source (for instance an electro-luminescent diode), a fiber and a phototransistor, all components that are already commercially available for a couple of dimes.

Over short distances, systems like that can approach the conditions required for telephone or TV-signal transmission, at a very low cost. For simpler applications in "on/off" controls in high-voltage buildings or in chemical plants, the concept of passband is relaxed and plastic fibers, which are thoroughly insulating and chemically inert, can be used to remote-control electrical systems, or on the other hand to fetch data provided by electrical system sensors.

Genuine Technology Transfer From the Atomic Energy Commission To the Industry

The performance of these plastic fibers is already good enough to warrant a technology transfer that recently led to the creation of the Optectron company. The decision to make this technology transfer and to create this company was made by Mr Mirat, director of the Saclay Atomic Research Center, and was based on patents and technical documents from the IRF laboratories in Saclay. The object of this company, which was co-financed by Epicea, is to manufacture plastic fibers, create associated systems and promote their use.

The company will be located near Saclay, where it can receive the support of the center research groups.

Saclay still has many other cards to play in this sector, in particular concerning enhanced organic materials for plastic fibers.

For instance, we can mention the expertise acquired in isotopic-molecules synthesis chemistry (SMM [Labelled Molecules Department]) or in light-isotope production (DESICP [Department of Isotopes Study and Separation and Physical Chemistry]). Indeed, we can contemplate using perdeuteriated polymers (in which all hydrogen atoms are replaced by the isotope deuterium), the effect of this isotopic substitution chemistry being to lower attenuation to 10 or 20 dB/km and to expand the spectral range toward the infrared.

The research means available at Saclay for laser spectroscopy and ultra-rapid electro-optical measurements make it possible to analyse and enhance fiber performance.

Other applications in the fields of punctual lighting, multifiber imagery for the connector industry, and endoscopy, are at the source of a considerable deployment of imagination and numerous patent applications in this field.

The experience acquired at Saclay by the ORIS-LABRA [Ionizing Radiation Office-Laboratory for the Biological Applications of Radiations] in the field of polymer cross-linking under the effect of radiations was applied to the sheathing of traditional cables, and it is now possible to contemplate the application of these proven methods in the case of multifiber optical cables.

On the occasion of this technology transfer, let us hope that many ideas for industrial products and commercial applications were transmitted through this small fiber and that they will radiate far and wide around the Saclay Atomic Research Center.

Technology Transfer to Industry

Paris CEA NOTES D'INFORMATION in French Jul-Aug 84 pp 10-12

[Article: "Technology Transfer; Creation of the Optectron Company"]

[Text] The object of the Optectron company created in 1984 is to manufacture innovative products, in particular in the following fields:

- Development of short-distance optical fiber links for data transmission (distances under 1-2 km), a subsector that has not been much used until now. In this sector, the company will avail itself in particular of the advantages offered by plastic optical fibers over other types of optical fibers.

The manufacture of these plastic optical fibers will be based on knowhow acquired by Optectron from the Atomic Energy Commission (IRF, DPhPE, STIPE).

- Utilization of the specific properties of optical fibers to make sensors, especially for robots and for use in disturbed and dangerous environments.

- New applications of cold-light transmission through plastic optical fibers from one or several hot sources (light bulbs for instance).

- Realization of compacted structures consisting of a large number of plastic fibers for displays in general (flat screens, possibly in connection with liquid crystals).

The Optectron company will operate in France and abroad. In the specific field of plastic optical fibers, the only companies to market products are the Japanese Mitsubichi and the U.S. DuPont de Nemours. However, the comparative characteristics of optical fibers manufactured by the Optectron company show that Optectron optical fibers are clearly superior, especially when it comes to insertion losses and numerical aperture. Therefore, the company could take a very important position abroad, in Europe.

In upstream research, the Optectron company will be aided by the Atomic Energy Commission laboratories (IRF, DPhPE, STIPE) (a licensing agreement including technical cooperation was signed on 2 April 1984 between the Atomic Energy Commission and Optectron), the laboratories of the National Center for Telecommunications Studies in Lannion, and the various universities involved in the manufacture and applications of plastic optical fibers (Montpellier, Nancy, Toulouse, Caen and Metz Universities, for instance). The company will carry out its own applied research and the required development. Already in its first industrial plant, it will have three large research laboratories, respectively in the fields of data-transmission systems, sensors, signal lights, and display systems.

Note that a contract was signed between the DuPont de Nemours group and the Optectron company, providing that the latter will be the exclusive distributor of DuPont de Nemours optical products in France.

Diversified Production

The company's product lines are extremely diversified. They include mainly:

- all so-called "plastic" polymer optical fibers (core and sheath). The first category of optical fibers manufactured will be that of "scintillating" or fluorescent fibers with a polystyrene core, which are mainly used in nuclear applications (for instance in calorimetry). These optical fibers, unique in the world today, are manufactured according to a technology developed by the Atomic Energy Commission, which is covered by several patents;

- all optical cables, in particular those made from plastic optical fibers. The cables will be single-fiber or twin-fiber (duplex) cables, and possibly mixed cables (optical fiber cables associated with metallic cables);

- all other components for future plastic optical fiber links, in particular connectors, passive components and subassemblies such as couplers, attenuators, switches, etc.; active components and subassemblies, in particular optical emitter and receiver devices that will include all the required optoelectronic interfaces;

- data-transmission links (analog or digital) for telecommunications as well as for industrial applications;

- optical links for sensors, in which the optical fiber can act both as a sensor and as a tranmission support; these are nearly non-existent in France, but their potential market is very large;

- cold-light (lighting) transmission links and various products with a "multiple-fiber compacted structure" suitable for applications having to do with display systems.

Domestic competition with respect to the use of plastic optical fibers, whether scintillating, fluorescent or clear, is practically nil. Internationally, this is also true of the applications of plastic optical fibers designed for the nuclear industry, whereas plastic optical fibers for data

transmission are widely used, especially in Japan; the Mitsubichi group specializes in the manufacture of fibers, and the Smitomo group (Osaka) in that of systems.

For its part, the DuPont de Nemours group has seemed more concerned until now by applications involving light transmission through plastic optical fibers.

Potential Market

The company's main customers are:

- French and worldwide research organizations involved in nuclear research (the European Council for Nuclear Research in Geneva, in particular, could become a large fiber consumer).

- French and international Post and Telecommunications Administrations (especially in France, for video communication applications).

- Various public and private organizations interested in industrial links contracts. Table 1 was prepared as a result of a recent survey of 46 French companies, all potential customers of Optectron.

Table 1. Potential Market of the Optectron Company

Sector	Percentage of the Optical Fiber Market
Chemical/petrochemical	30.0
Oil	5.6
Electricity	6.0
Metallurgy	3.7
Mechanical engineering	12.3
Electrical engineering	10.0
Transportation	4.7
Food industries	4.0
Glass	3.4
Other sectors	20.3

- Various public and private organizations interested in contracts for lighting, and signaling and display systems in the following sectors (to name a few): industrial lighting, signaling (public works, Independent Paris Transport System, French Railroads, etc.), data processing, aeronautics and space sector, weapons, medical equipment, etc.

- Various public and private organizations interested in sensors, and more especially in measuring various parameters such as: temperature, velocity, pressure, movement, level, current, magnetic field, nuclear radiations, pH, high-voltage cable breakdowns, etc.

In time, the sensor sector should include a great many applications.

Table 2. Five-Year Sales Projections (Thousands of Francs)

	France					Exports*
Year	Plastic Optical Fibers, Components And Sub-assemblies	Industrial Links	Telecom Links	Lighting, Signaling, Displays	Sensors	Percent of Sales in France
1 (1985)	3,500	1,500	850	500	1,000	12
2	4,000	5,000	1,500	800	1,200	15
3	5,000	7,500	2,500	1,200	2,000	17
4	6,500	10,000	3,500	1,800	4,000	20
5	7,500	15,000	5,000	2,500	6,000	25

* Export sales figures should be added to sales figures for France.

Marketing Ojectives

Table 2 gives five-year sales projections in thousands of francs (exclusive of engineering and sales contracts for which Optectron would act as a distributor for DuPont de Nemours).

Note that export sales projections are probably conservative, especially in view of the fact that European competition is practically nil for the time being.

Optectron

Created in April 1984 in the context of the "Technology Transfer" operation of the Saclay Atomic Research Center, the Optectron company is a public company with a capital of FF 1,000,000. It is distributed as follows:

- Epicea . . . . . 25 percent
- Sofinnova. . . . . 15.4 percent

The mutual investment fund of the National Bank of Paris:

- Natio Future Fund. . . . 9 percent
- Creative Group . . . . . 50.6 percent.

The operations of the Optectron company in France and abroad involve:

Research, development, manufacture and sale of:

- all optical fibers, in particular plastic optical fibers, and associated equipment;

- all optical-fiber sensor systems and related equipment.

Any representation and distribution operations on behalf of French or foreign companies, in the sectors in which the company operates in France.

At present, Optectron is sole distributor for France of DuPont de Nemours Crofon products.

The utilization license and corresponding technical assistance concerning the manufacture of plastic optical fibers was granted by the Atomic Energy Commission in an agreement signed on 2 April 1984.

Location: the new company will be located in the Courtaboeuf industrial zone, near Orsay.

Epicea, Company for the Promotion of Innovation at the Atomic Energy Commission

Epicea is a public company created on 18 June 1980 under the law of 11 July 1972 concerning Innovation Financial Companies.

The company was created with an initial stock of FF 10,000,000 distributed as follows:

- Atomic Energy Commission . . . . . 30 percent
- National Bank of Paris . . . . . 20 percent
- French Foreign Trade Bank. . . . . 10 percent
- Lyons Water Company (Caspar) . . . . . 10 percent
- Elf-Aquitaine (Inovelf). . . . . 10 percent
- Paribas (Opfi) . . . . . 10 percent
- Sofinnova. . . . . 5 percent
- Sofinnove. . . . . 5 percent

Its object is to contribute to the implementation of acquired knowledge and results, directly or indirectly through the Atomic Energy Commission, and to the promotion of innovation in the corresponding sectors, the nuclear energy sector being specifically excluded.

For the time being, the Atomic Energy Commission focusses its innovative activities mainly on the following:

- the bio-industry and biomedical technologies;
- the energy (renewable energies, energy savings);
- robotics;
- electronics and data processing;
- new materials and raw-material savings;
- the agro-industry.

To Whom Is Epicea Geared?

Epicea is geared to industrial company heads or company founders who wish to develop a new product or process based on a technology developed at the Atomic Energy Commission or in which the Atomic Energy Commission has special expertise.

9294
CSO: 3698/54

U.S. RESTRICTIONS ON TECHNOLOGY TRANSFER REVIEWED

DW191217 Duesseldorf HANDELSBLATT in German 19-20 Oct 84 p 2

[Eberhard Wisdorff article: "More Than Just Security Interests"]

[Text] Etienne Davignon, vice president of the Brussels EC Commission, was probably amazed that the EC industrial and economics ministers, who were gathered in Luxembourg, accepted his proposal without any trouble. A few days ago Davignon asked them to have the Washington ambassadors of the member-states compile an inventory of U.S. practices concerning technology transfer limitations within a few weeks.

Davignon received a green light even though dealing with this subject in the Community is not easy. Normally the problem is discussed within the framework of NATO, whose member-states, together with Japan, control the transfer of militarily relevant technology in the pertinent Paris committee (COCOM) [Coordination Committee for Export Control] and make unanimous decisions on it. However, EC member-state Ireland, for instance, does not belong to NATO.

Enhanced Array of Documents

The fact that the United States uses security policy to hamper the other Western countries' trade of products, even those that are just suspected of being militarily useful, has aroused growing concern among the member-states. This concern is reflected, among other things, by the approval of the Brussels commissioner's recommendations. Brussels quarters draw attention to the voluminous array of documents the U.S. Administration has had at its disposal for some time: the export administration act of 1979, which is now under congressional review; the Arms Control Act of 1976; the Atomic Energy Act of 1954; and the Nuclear Nonproliferation Treaty of 1968. Even more important is the intensification of additional regulations and their restrictive application instituted by the U.S. Defense Department. Lately this application is aimed not only at exporting technology to the East bloc but also at increasing restrictions in conveying technological know-how from the United States in general.

In this connection, the partial inventory available in Brussels, even before the joint study of the member-states was made, cites, for example, the constantly increasing application of the so-called no foreign (NOFORN) regulation according to which certain conferences supported by the Pentagon remain

restricted to U.S. citizens. Moreover, the distribution of published technological knowledge is being restricted. NASA's list of technology restrictions is cited as an example. In addition, Brussels quarters say, the disclosure of U.S. technical data is generally restricted to certain participants in meetings that are held by private enterprises, as happened recently at a congress in Amsterdam.

These are but a few examples to which attention is being drawn in Davignon's circles. A few weeks ago the Federal Government itself, in a study still kept under lock and key, also complained about the increasing U.S. pressure. And Belgium is still discussing the Pegard case: A milling machine manufactured by this subsidiary of a German company for the Soviet Union had been bought by Brussels for its own Army under U.S. pressure. The Americans held back the promised compensation when the company prepared to deliver additional machine tools to the USSR.

Neither the EC Commission nor the member governments doubt the necessity of the COCOM procedure and the limitation of technology exports that may have military relevance.

Nourished by the latest U.S. practice, the quarrel over the natural gas pipeline deal, and earlier U.S. attempts to obstruct deliveries to nuclear power plants, the assumption that justified Western security considerations and U.S. trade and competitive interests overlap in such a manner that is hardly transparent anymore and that is to the advantage of the U.S. economy, proves correct.

Agriculture Quarrel But a Trifle

As far as EC Commission member Davignon is concerned, the problem goes far beyond individual cases such as the Pegard case. To him this problem with the United States is tantamount to a threat to the industrial autonomy of the Community, which is trying to catch up in advanced technology through joint programs in the fields of information, telecommunications and biotechnology. Compared with the inevitable controversies connected with this matter--and to use Davignon's own words--the continuous agricultural quarrel with the United States is but a trifle.

CSO: 3698/43

SOVIET SPIES NAMED IN SWEDISH BOOK ON INDUSTRIAL ESPIONAGE

Stockholm DAGENS NYHETER in Swedish 23 Oct 84 p 7

[Article by Thorwald Olsson]

[Text] The Soviet Union has around 60 (sixty) spies working in Sweden on a regular basis. In a new book, "Industrial Espionage," 33 representatives for the KGB, the Russian security and intelligence service, and the GRU, its counterpart on the military side, are named.

The head of the KGB in Sweden--according to the author of the book, journalist Charlie Nordblom--is embassy counselor and Major General Vladimir Batchkirov, 43. Embassy counselor Yuriy Kiselev, 54, is named in the well-informed book as the GRU's chief in Sweden.

"I have such good background material for my revelations after 18 months of research that I can confront the Soviet Union in the name of freedom of the press," author Nordblom told DAGENS NYHETER.

"Industrial Espionage" outlines what has been clearly indicated in newspaper reports in the past.

Intelligence agents are concealed among diplomats and servants at the embassy in Stockholm, the consulate in Goteborg, the trade delegation in Lidingo, the Intourist tourist bureau (Stockholm), the Matreco automobile company (headquarters in Sodertalje), the Aeroflot office (Stockholm), the APN news agency and other Soviet representatives in Sweden.

Book Names 33 Agents

The book gives 33 names of people the author believes to be officers of the KGB and GRU. He says of KGB chief Vladimir Batchkirov:

"He was formerly stationed in the Netherlands. There he really infiltrated the budding peace movement whose subsequent attacks on the military buildup by the superpowers gradually came to be directed solely against the United States."

The peace movement's major point of attack was the American proposal to deploy cruise missiles in the central European NATO countries to offset the already begun Soviet deployment of SS-20 missiles in the Warsaw Pact vassal states.

Vladimir Batchkirov was already a colonel in the KGB when he served in the Netherlands in the mid-1970's. His effective work there brought him a new promotion to major general. His subordinates in Stockholm now address him as "general." Batchkirov has diplomatic status on the basis of his cover job as embassy counselor. His posting is interpreted by a Dutch source as a gradual Russian relocation of the center of the peace movement to Sweden.

However the peace movement is not the primary goal of Russian spies in Sweden even though infiltration there is regarded as important. High technology, i.e. the whole range of technological development, is the main work area of these spies.

"Industrial Espionage" claims that advanced technological and scientific information is acquired partly through an extensive gathering, analysis and evaluation of open sources and partly through acquiring Swedish technicians, research workers and businessmen as agents or using them as informers.

The book describes how the KGB and GRU have a network of agents everywhere from the embassy in Marieberg, Stockholm, to APN, the news agency where both Russian and Swedish journalists work.

A Swedish colleague there told DAGENS NYHETER with reference to the new disclosures:

"There is no reason to say that a journalist has any other tasks in addition to working as a journalist."

Confirmation

Even before "Industrial Espionage" came out with this broad and very meticulous account of the working conditions and ramifications of eastern espionage in Sweden, the alarm had been sounded more than once.

Security Police (SAPO) chief Sven-Ake Hjalmroth stated in a big DAGENS NYHETER article this March:

Industrial espionage against Sweden is on the rise. More and more diplomats are here for the purpose of spying!

The disclosure of names now comes as a further confirmation of these alarming reports.

In Swedish industry, as in the military, there has been increased alertness in the area of security in the last few years.

Hans Wermdalen, security chief for the Ericcson concern and a former SAPO man, told DAGENS NYHETER:

"There are a lot of true things in the book. For example several workers in our concern have voluntarily revealed that eastern agents tried to recruit them as spies within the company. We have also been exposed to infiltration efforts in connection with the hiring of technicians. And there have also been attempts to circumvent the embargo provisions of the United States and its western allies."

The Soviet Union does not work solely with its "own" agents. In addition to a sophisticated pattern of recruiting domestic spies, it also has access to resources among the delegations of its satellite states. The Polish and East German embassies and consulates, for example.

Hans Wermdalen of Ericsson feels it is important to provide all Swedes with security information:

"People who work with highly advanced technology should observe great caution," he emphasized. "They should not hand out information about their company or their job assignments to just anyone. I think caution has increased here in recent years as a result of all the disclosures in the mass media."

Wermdalen also thinks Swedish politicians must now take action to tighten up legislation to combat industrial espionage:

"They should legislate penalties that are tangible," he said. "In this respect we are far behind our neighbors in Denmark and Norway, for example."

No comment could be obtained Monday from the Foreign Ministry or from Foreign Trade Minister Mats Hellstrom in relation to the revelations in "Industrial Espionage."

Mats Hellstrom wants to read the book carefully first.

And the Foreign Ministry was fully occupied with the exchanges surrounding the Soviet violation of Swedish air space over Gotland.

PHOTO CAPTIONS

1. Vladimir Batchkirov is a major general in the KGB with a cover job as embassy counselor in Stockholm. He is the KGB's chief in Sweden.

2. Valentin Gubernatorov is a correspondent for Moscow Radio and TV. He works for the KGB.

3. Vladimir Dimitriev, KGB officer. Cover job as assistant press attache since 1980.

4. Viktor Tatarintsev, captain in the KGB. Tatarintsev has shown great interest in Swedish technology.

5. Nikolay Pyatkov belongs to the KGB. Cover job as third embassy secretary since 1982.

6. A Russian spy at Stockholm Central (RR station). Between Christmas and New Year '82 Russian diplomat Pyotr Skiroky was expelled.

7. The Russian trade delegation, Ringvagen 1, Lidingo. Finland is the only country in Europe where the Soviet Union has more representatives than it does here.

8. The embassy, Gjorvellsgatan, Stockholm. There are 80 Soviet citizens here. Of the 38 diplomats, 26 are officers in the KGB and GRU.

9. Elorg, a small office in Sundbyberg. Tries to buy Swedish and American computer equipment.

10. Aeroflot airline company, Sveavagen 20, Stockholm. "Strong military affiliations."

11. Intourist, Sergelgatan, Stockholm. The tourist agency is a cover for the KBS [as published].

12. Consulates in Goteborg and Stockholm. Vyatyeslav Timofeyev, who was expelled in 1983, worked in the consular division.

13. Matreco Trading Company, headquarters in Sodertalje. Doubled its personnel in the last 10 years although there was no gain in the sale of Russian cars.

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MODERNIZATION NEEDED, SAYS NETHERLANDS TECHNOLOGY POLICY REPORT

Rijswijk PT AKTUEEL in Dutch 26 Sep 84 p 1

[Text] Last week Minister Van Aardenne of economic affairs sent the technology policy report to the Lower House. In it the plans of the cabinet concerning technology policy for the coming years are listed. In fact, not much is new, although the report does clearly give strength to certain earlier well-publicized intentions, enabling research development to focus in on the needs of industry and the priorities established to achieve them. Something that is quite new, however, is the announcement that a total of 50 million guilders has been earmarked over a period of four years to be allocated to the production renewal plan, which is soon to be published. In that connection, the technology policy must take shape in the form of a modernization of Netherlands industry.

The 1984-1985 technology policy report is the first of its kind and will from now on appear yearly. It contains no financial data but does include a survey of the activities performed by the various departments within the framework of the government technology policy. The report is linked to the policy plan of the minister of economic affairs, drawn up in connection with the Technology Policy Project, which was organized at the beginning of this year by a project group under the leadership of W.C.L. Zegveld, professor and doctor of engineering, and in which a plea is made for a technology policy that is more intensive and more closely aimed at the market sector. According to the policy report, the latter is also one of the most important priorities in the policy for the coming years. The complete list of priorities is as follows:

1) The strengthening of the link between higher education, research and market sector.

2) The expansion of the policy relating to those fields of technology now in need of attention and thos esearch programs currently aimed at innovation;

3) The fostering of market-centered activities at the larger technological institutes;

4) The strengthening of the infrastructure and expertise transfer potential;

5) The intensification of international bilateral contacts;

6) Tighter application of the policy with respect to the introduction of new technologies, especially as far as the consequences for social organizations are concerned.

Seen from these angles, a number of scientific technological areas receive special attention, in particular information technology, environmental technology and biotechnology. But in addition, further attention is given to the development of policy plans for construction technology, medical technology and technologies with applications to new materials.

The regulations for the stimulation of innovative ideas (INSTIR) are intended to strengthen the market sector in such areas as technical development credit, the recently published quality program and the production renewal program that will soon appear in print. For the latter program the government will earmark 50 million guilders to be allocated over a period of four years. The new stimulation plan contains a number of outstanding features that were made known last week with the presentation of the policy report. For the advancement and application of modern production methods in industries, the government is thinking of several plans, among them the notion of supporting feasibility studies which would precede the implementation of the production renewal program, distributing more information and developing new services in these domains (for example, in the industrial robot field). In addition, scientific research will be stimulated in the future, and, in vocational training programs, more attention will be given to production renewal technology.

In the coming year a great deal of attention will be paid to improving the assessment of market sector needs by the technical-scientific infrastructure.

International

The policy report gives information concerning the increased number of research programs aimed at innovation (IOPs). For these IOPs a new organization structure was recently established. Furthermore, the policy survey mentions that after 1984, the govern-

ment will continue to give a certain amount of support to the activities of the transfer points.

For the coming year it has been decided to set up a program of action directed toward the relationship between education, research, technology and the market sector. In this domain attention will be given primarily to the furthering of personnel exchanges between industries and higher education, training and research at the highest levels, contract research and the safeguarding of expertise, information transfer and the improvement of relations between higher vocational training and medium and small businesses. For a number of special technological fields, the proposals will be developed for an accelerated introduction of the elements of this program.

The Netherlands accounts for about one percent of the expenditures for research and development in the world, thus indicating the importance of international contacts and cooperation. The intentions of the cabinet in this respect are directed toward the strengthening of the so-called international technology network, as the most important direction for fostering the advancement of multilateral and bilateral cooperation. On the multilateral level, the activities are directed in particular toward mutual agreements, in order, for example, to eliminate obstacles to the international market. The liberation of the domestic market from the domination of the EC, to explore new technologies, is an essential aspect of the policy with respect to EC research programs. As far as the strengthening of bilateral contacts is concerned, its principal objective is the realization of concrete technological cooperation in certain areas in need of attention. Thus a symposium was held recently with the GDR on the subject of information technology, resulting in cooperation agreements. The cabinet also intends to continue to develop this form of cooperation with the nations of the third world, for example.

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SCIENTIFIC AND INDUSTRIAL POLICY

PHILIPS MEETS RESEARCH NEEDS WITH NEW HIRING PLANS

Amsterdam NRC HANDELSBLAD in Dutch 6 Oct 84 p 11

[Article by Dick Wittenberg: "Philips To Attract Hundreds of University Graduates Through 1990"]

[Text] Eindhoven, 6 October--Every year through 1990 Philips will be hiring at least 300 university graduates with technological training. This is in effect twice the number hired during the period from 1960 through 1980. Mr A. Vaandrager, director of the central social sector of the Netherlands Philips Industries, speaks about "a revolutionary development." On the short term, there is talk within Philips itself of a still greater increase in the need for university graduates with technological backgrounds.

This year and also next year, Philips will be hiring between 450 and 500 engineers and ABDs in the Netherlands. Also, the number of HTSs [Advanced Training Schools (junior college level)] that have agreements with Philips is growing apace. And there is a particular need for experts in the fields of electrotechnology, physics, information technology, and in lesser measure, mechanical engineering. Over and above these fields, there is a great need for future managers capable of supervising entire operations. According to Mr Vaandrager, the growth is in particular the result of tremendous developments in technology.

"The use of the computer in research and development offers heretofore unknown possibilities to simplify and speed up the work." P. van Grimbergen, head of personnel affairs at Netherlands Philips Industries, stresses that computers are not simply a "technician's hobby." "We are dealing with a matter of survival. An undertaking that is not now activating its expertise potential will not be able to compete in five years' time; it is as simple as that. The race will last a good many years yet."

Mr Vaandrager calls it "a matter of logic," that business firms continue to hire extra university graduates, particularly in the Netherlands. "In the final analysis, an important segment of research and development is concentrated here. The growth indicates a strengthening of the Netherlands' position as the expertise center for Philips." On the long term, that position is exposed to a potential danger. For Philips not only needs more university graduates, but also graduates of a higher level. If the Netherlands cannot produce such people, the concern will have to bring them in from abroad. Not that Philips is currently dissatisfied with the quality of university students in our country, Mr Vaandrager hastens to explain.

But one day now, the future will make other demands. "The time is coming when Philips' scientific research will range so widely that one or two others at best will be able to keep pace with us. You must not be surprised if one or more developmental research technicians at Philips turn out to be Nobel Prize winners one of these days. It is essential for university institutions in the Netherlands to keep up with such quality growth. They must also learn to think bigger."

Two-Phase Structure

According to Mr Vaandrager, attempts to improve the level of quality that is so very much to be desired, are weakened by the inability to give shape to the new two-phase structure in scientific education. "Philips has never asked for such a two-phase structure, but we say that there is great merit in such a design," says Mr Vaandrager. "The first phase would produce graduates at the former level in four years' time, we hope. Then in the second phase the best of these graduates would then work toward attaining further qualifications. The quality would be then further extended."

"The blueprint looks very good," comments Vaandrager. In practice it is not so easy to succeed in getting the second phase smoothly off the ground. All kinds of administrative and financial problems are involved. In The Hague reigns the attitude: If it is really so difficult, then don't do it. Such an outlook admirably suits plans for retrenchment. There are already clamors to push the second phase off onto graduate education programs. I find that that is tantamount to shirking one's responsibility. Instead of that, the minister says: "The future of technology in the Netherlands is at stake."

Lamp

Mr Vaandrager wants to prevent his plea for an increase in the quality of scientific education from degenerating into the lan-

guage of blackmail typical of a multinational in a small country. But if Philips can no longer get top people in the Netherlands, they will have to get them from elsewhere." According to P. van Grimbergen, that would be nothing less than a disaster for the Netherlands. "When the cost of wages in our country rose to excessive heights, many production activities moved to countries with lower wage structures. Such a phenomenon is always reversible. But if ever Philips were forced to move its expertise center elsewhere, that would never come back."

The supply of Netherlands university graduates with technical training is still sufficient for the time being, to cover twice Philips' needs. But five percent of the scientists who work for Netherlands Philips Industries come from foreign countries. P. van Grimbergen foresees problems after 1990. "For under the pressure of technological developments, the demand for scientifically trained technicians is also accelerating very rapidly in the rest of the industrial world. The number of graduates will have to increase sharply in order to fulfill growing needs."

Whether a real scarcity will come to exist depends, according to Mr Vaandrager, upon the strength of recruitment programs in the technically-oriented graduate schools [university level] and the advanced training schools [junior college level]. Another consideration is that more women will begin to find their way into technical education.

Sucking Up All the Talent

P. van Grimbergen emphatically rejects the suggestion that Philips has set out to suck all the talent out of the universities. According to him, there can be no question of a brain-drain stimulated by the higher salaries offered by industry. "If many people are attracted to industry, that is because of the structure of the university institutions, which makes working there an unattractive proposition," claims Mr Vaandrager. "The effects of the law on university administration reform come into play here. It is a case of overdemocratization. More important is the fact that the necessary facilities to carry out the work are lacking. Budgets for research are being cut to the bone. Financial remuneration comes only in the last place." P. van Grimbergen: "We shall take care that the movement of professors from industry back to the universities is not stopped. After all, we are the ones who profit from a good scientific education. There has to be a kind of equilibrium between industry and university."

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SCIENTIFIC AND INDUSTRIAL POLICY

FRG 'PRESSURED' NETHERLANDS INTO 'MEGA-PROJECT'

Amsterdam ELSEVIERS WEEKBLAD in Dutch 20 Oct 84 p 7

[Report by Willem Kraan: "The Blind Faith of Economic Affairs"]

> [Text] Ambitiously and aggressively Philips and Siemens announced the development of modern electronic chips. Is the Europe of old getting back on its feet again after all? To all appearances it is. The support of Economic Affairs for the project also seemed to go in that direction but appears to be based on practically nothing.

Many comments can be made on the plan just announced by Philips and Siemens to start developing and producing so-called "megabit chips." But no sensible person can avoid acknowledging that a lot of nerve is being shown with this /Megaproject/. The question is, however, whether it is the nerve of the kamikaze pilot or rather the courage of the carefully calculating stuntman who is practically certain that not much can go wrong.

That question cannot be answered so easily because Philips and Siemens have carefully avoided showing their precise intentions. Are the two companies continuing on the path of the chip technique already taken, and will they ultimately come on the market with a product which essentially doesn't differ much from the showpieces which competitors are flaunting already now? Or are the two European electronics giants planning a technical coup which will give its competitors in Japan and the United States something to ponder for some time? Those are questions which cause every true European to waver between hope and fear.

The Megaproject turns around two pivots: / money and technique/. One is not possible without the other, of course, but these two pillars can still be analyzed separately. First, the technique.

There are many types of chips, but there are two which stand out: the computer chips and the memory chips. The first type is perhaps better known under the name microprocessor. Such a computing and controling circuit is of a staggering complexity and forms the heart of every computer. However, the microprocessor must be able to store somewhere close by the unimaginably large quantity of data it processes. A memory chip is needed for that.

In contrast to the microprocessor, the memory chip is not complicated at all. On the contrary: it is an extremely monotonous stack of electronic switches and each switch can contain the basic unit of electronic information: a zero or a one. The largest memory chips now available in stores can contain 64,000 ones or zeros, or 64,000 bits. But chips with a capacity of 256,000 bits have been out of the experimental stage for a long time already and will also fly over store counters in droves within the foreseeable future.

More Difficult

The road to even greater memory circuits appears easy: simply stick four chips of 256,000 bits together and you have a megachip. If it were that easy, Philips and Siemens would not have to make so much fuss over their plans. Thus we may accept that in practice everything is much more difficult. The point is that the joining of four circuits, be they in one unit or not, does not really yield an improvement in price or performance. It only becomes interesting when one succeeds in incorporating four times as many memory cells on the surface originally utilized. And that, precisely, is the goal of the Megaproject.

The difficulties which arise in doing so cannot be overestimated. The manufacture of chips is in great part based on the etching of minuscule conducting channels in the semiconductor material, silicon. The width of a channel, or track, in a megachip must lie between 0.5 and 0.7 microns. (One micron is one thousandth of a millimeter. For comparison: the average human hair is 75 microns thick.) It is clear that no Rembrandt, no matter how fine his etching needle is, would have a chance in this so-called sub-micron world. Roentgen or ion beams must be used, which are aimed at the material with awesome precision. Many things can go wrong in such a process. Dust is disastrous, vibrations are disastrous, irregularities of one thousandth of a millimeter are disastrous. In short: people with all their good and bad peculiarities are disastrous. The entire process must be automated with the aid of extremely expensive supercomputers.

Extremely high demands are made not only upon the mechanical and electronic precision of the process, but chemically all sorts of things can go wrong too. The firm Honeywell, for example, was troubled in its development lab by a stubborn layer of dirt in one of the little channels etched with so much effort. They tried to eliminate it with all sorts of tough cleaning agents such as sulphuric acid, but the mess wouldn't clear up. After much searching, it turned out that teflon had been created unintentionally in the mixture of fluorine and carbon gases which were needed to make the chip. Indeed, the same teflon as that in the uncrackable frying pan. A lot of effort was expended to prevent the anti-stick layer from forming again in subsequent experiments. Actually, that was a case of a relatively common chip. The technicians and scientists of Philips and Siemens will undoubtedly run into many types of other extremely tough problems behind the scenes in the next few years.

Ten Years

And now the money. The excessive accumulation of technical problems in continually decreasing the size of chips has caused an enormous cost increase in chip factories. Ten years ago a completely equipped chip factory cost 10 to 20 million dollars. Currently five times as much has to be put up before production can be started. The plans of Philips and Siemens extend 10 years into the future, so it should not be surprising that the required investments are higher by another factor of five.

Siemens stated that 2.2 billion german marks have been put aside for this project. Eight hundred million marks are intended for research, and the rest will go into the construction of the factories. Philips was only willing to say that the total project will cost "several billion guilders." At Philips' physics laboratory a new lab is being constructed for 240 million guilders, and a special building with the necessary supercomputer will require a total of 160 million guilders.

What is characteristic for /high-tech/ developments of this type is that the number of jobs is not proportional to the enormous investments, even though cheering newspaper headlines last week gave different impressions. Philips plans to recruit about 500 employees, 300 of whom will work in the laboratory and 200 in the chip factory in Nijmegen once production has started. The tricky question, of course, is whether these specialists can even be found in the Netherlands. Philips mentioned "tensions expected in the labor market." Looking at it realistically, one must conclude that a considerable number of the 500 specialists will probably have to come from abroad, so that the effect on work opportunity is negligible.

The support of the Dutch and German governments for the Megaproject is nice, not to say indispensable. The German Department of Research and Technology (BMFT) is putting up 300 million german marks, and the [Dutch] Department of Economic Affairs (EZ) is coming across with 200 million guilders, including the WIR [Investments Accounts Bill] premium. That creates faith. Surely the Dutch Government wouldn't, without good reason, make available hundreds of millions of tax guilders in a period during which it is being painfully confronted with the consequences of thoughtless aid operations from the past? At least, that's what every rational Dutch person will argue. Reality is different, however.

Faith

The subsidy was pledged at the recommendation, or pressure, of the BMFT. At EZ no one has any idea if the money will prove to be a good investment. It is blindly putting faith in the prestige of its German colleagues and that of the two companies involved. What is more; at EZ they don't want to know the details, for knowledge creates /responsibility/, and that has become a dirty word under [Minister] Van Aardenne. A spokesman of EZ formulates it a little more politely:

"If we ourselves were to recruit experts in connection with this project, we ourselves would also have to carry the responsibility for the success of the project. If you don't lay claim to that--and that is EZ's position--then you check only the minor terms. Therefore we did not have a comprehensive study made either."

Apologetically he adds that the subsidy is not definite. But obviously no one believes in the possibility that EZ would publicly abuse Philips by ever going back on its promise, under whatever circumstances. EZ is, however, negotiating with a number of scientific people to follow the project and report on it.

Kamikaze or Stuntman?--that question remains unanswered. A handful of other companies are already far along with the development of the megachip. Not long ago IBM proudly distributed a photograph of its newborn, and at the Efficiency Fair the item itself could actually be admired. Are Philips and Siemens going to put billions into the development of a product that shortly can be bought in stores for a few bills? No one believes that.

Therefore it seems very possible that in Eindhoven and Munich they are working on a few technical details which are to make the product into a formidable competitor. Perhaps they have a few technical details on the backburner which will make the chips faster than the circuits being worked on in the United States and Japan. But to be truthful, that is speculation. The person who remains rational wavers between fear and hope.

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BRIEFS

UK SCIENCE POLICY--A book has recently been published which could become an important contribution to the analysis of research techniques and development in Great Britain. The book is entitled UK SCIENCE POLICY and deals with the public sector's policy concerning research within different areas. Issues which are taken up in the book include: how one should be able to decide policy for research and development so that it will become an important guideline for decision makers, how decision making shall be organized, and how the entire process will be put together. Since there is not currently a national research forum, research is carried out within the different departments. This means that research expertise tends to concentrate itself within these ministries, and they in turn do not have this work as their main task. The book does not provide a solution to the problems, but it provides a good basis for further consideration and discussion. The book is published by the Longman Group Ltd, 6th floor Westgate House, High Harlow, Essex CN20 1NE, and costs 16.95 (pounds sterling). [Text] [Stockholm TEKNISK 'TBLICK in Swedish No 7, 1984, p 4] 12562

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